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INTERNATIONAL JOURNAL OF COMPARATIVE PSYCHOLOGY

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PREFACE

Ethel Tobach, Editor
American Museum of Natural History

I became aware of the first three documents presented in this issue of the Journal some years ago when I made the acquaintance of Dr. Deborah Malakhovskaya at The Sechenov Institute of Evolutionary Physiology in the city then called Leningrad. Dr. Malakhovskaya is the daughter of one of the most productive Russian comparative psychologists, B. I. Khotin, whose career was cut short by a political policy that did not approve of the kind of research he was doing, and apparently, of the people doing such work. His biography testifies to these statements, and he should be honored for his steadfastness and bravery, as should all other scientists and people who have been, and are, the victims of societal repression.

The number of people who made this issue of the Journal possible testify to the international significance of the events for the scientific community that concerns itself with the study of the development and evolution of behavior. This community owes a special thanks to Dr. Malakhovskaya who persevered in her responsibility to the history of the science and made these documents available, and to her husband, Dr. Lev Malakhovskii, a linguist whose expertise was always available as consultant and arbiter of the many different possibilities open to me as editor in the difficult task of translating the material.

In the course of the communication difficulties engendered by the profound changes in the former USSR and the new Russia, I received the help of colleagues in Moscow: Leonid Baskin, I. I. Poletaeva and A. F. Semiokhina, for which I thank them. In New York, I was aided especially by the prodigious talent and hard work of Ruth Newman who assisted in every phase of the editing, and without whose help this issue of the Journal would not have become a reality. The assistance of Charles I. Abramson and Alexander Skolnick is gratefully acknowledged as well, as is the work of Patricia Brunauer and Muriel Williams, who produced the hard copy.

Because of the difficulties of communication with the various individuals abroad, I have had to make demanding decisions as to paragraphing, spelling, language, reference citation and so forth. I accept the responsibility for these decisions. The sequencing of the documents is also my decision and was based on the customary format of the Journal. This foray into the discipline of history was fraught with uncertainty, and I apologize to the historians who will find fault with the shortcomings of the presentation. I trust that the material is of sufficient intrinsic interest to stimulate scholars to continue in the discovery of the appropriate documents and information that will further enlighten the scientists and historians about this period in the history of the discipline.

I particularly wish to thank the commentators who took time out from their own research to write for this issue of the Journal. I found their articles informative and fascinating in the intriguing ways in which they complement and contradict each other, reflecting the complexities of the societal processes by which the three documents were produced, and I trust the reader will find the materials worthwhile.

BORIS IOSIFOVICH KHOTIN (1895–1950)

D.B. Malakhovskaya (Khotina)
Sechenov Institute of Evolutionary Physiology

B. I. Khotin was born on September 25, 1895, in St. Petersburg (later Leningrad, now St. Petersburg). He acquired his medical and biological education in the Bekhterev Neurological Institute and at medical departments of the universities in Derpt (later Tartu, Estonia), Tomsk and Irkutsk (Siberia). In 1922 he graduated from the Irkutsk University and in 1924 from the Institute of Social Education in Leningrad.

Having taken an interest in problems of comparative psychology, Khotin began to work under Professor Wagner at the Herzen Pedagogical Institute and soon became his assistant. At the same time he worked as a neuropathologist in Professor Astvatsaturov's Clinic of Nervous Diseases and lectured on medicine and biology for working people.

From 1925 to 1935 Khotin was a research worker at the Bekhterev Institute for Brain Research, at first in the Biogenesis Department and later in the Department of Comparative Psychology and Physiology. Here he performed a number of investigations in the field of learning and imitation, using a restructurable maze of his own design.

Aiming at the studying of instincts and habits of animals in natural conditions, Khotin organized two expeditions to the Murmansk Seacoast and the Novaya Zemlya Islands (1931–1934), where he made observations of bird colonies and performed many field experiments.

In 1935 Dr. Khotin's scientific work was interrupted: he was exiled to Central Asia, and for several years worked as a neuropathologist in the hospitals of Alma-Ata and other places. In 1941, at the beginning of the war, he joined the army and served as neuropathologist at frontline hospitals in the USSR, Poland and Germany.

In 1945 he was discharged with medals and returned to Leningrad to resume his work at the Institute of Brain Research. There he continued his investigations in the field of comparative psychology and in 1947 got

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the candidate degree for his dissertation “On phylo- and ontogenesis of imitation and learning of vertebrate animals.”

On September 2, 1950, B. I. Khotin died after a grave and prolonged illness.

Dr. Khotin was married to Sarah Yakovlevna Khotina-Doron, a neuropathologist, and had two daughters.

COMPARATIVE PSYCHOLOGY AS A COURSE OF STUDY IN THE UNIVERSITY AND IN OTHER HIGHER EDUCATIONAL INSTITUTIONS

MEMORANDUM WRITTEN BY V.A. WAGNER
FOR THE NARCOMPROS (MINISTRY OF EDUCATION)

A. E. Davier, in his paper on the influence of biology on the development of modern psychology in America, gave the following picture of the evolution of psychology. Until 1887, psychology in the modern sense of this word hardly existed in America. The study of the soul (mind, *l'esprit*) was presented as the "philosophy of thought" (*philosophie mentale*). The main official representatives of this study were Porter and Cosh, who were active figures in the Reformed Church in the colonies.

In 1887, with Ladd's work on "Elements of Physiological Psychology," a new era began. It is interesting that Ladd also was a figure in the church and a successor of the two men mentioned above. Beginning with his work, physiology of the nervous system became an inevitable preface to any investigation of the soul.

After that, a number of authors followed who eventually began to speak about psychology in the strict sense of this word, about consciousness and so on. Only then were efforts made to make psychology an independent field of knowledge. At last, from the direction of physiology and from that of experimental psychology, a new direction emerges: structural and functional psychology.

At first, all the authors were partisans of introspection. They all believed that the phenomena of thought were different from physical phenomena.

In 1904, a new trend became evident: genetic psychology appeared, that is, the study of the development of thought both in the child and in different races, and at the same time the study of the psychic capabilities of animals set in (Baldwin, Thorndike, Senwings). Psychology became closer and closer to biology. Finally, in the last ten years, the doctrine of behaviorism appeared, which eventually began to aim at completely destroying introspection.

Thus, as new authors changed one another, the trends in psychology changed from those close to a fetishistic world outlook to an extreme form of behaviorism completely negating psychology as a discipline of an exact science, because an exact science deals only with the phenomena of physics or chemistry since all physiological knowledge is derived from physics and chemistry and nothing more.

The evolution of psychology in Europe took a similar course.

One should not think that the advance of this approach to thought cancelled all preceding approaches. It was not so. It is the dominance of the fetishistic world outlook which was cancelled and defends its positions the more rigorously since its opponents excited by the attacks expose their weak points, permitting the metaphysicists to attack them there.

Therefore, it is now easy to understand what contemporary world literature is, so far as it can be seen in the annals of physiology of the nervous system and of psychology. (*L'Annee Psychologique*, *L'Annee Biologique*, etc.) These publications demonstrate that in Europe and America there is a complete set of clearly expressed schools of psychology, but there is no psychology as an integrated discipline.

These schools are:

1. The old school of introspection
2. The school of experimental psychology (Wundt)
3. The old zoopsychological school (Büchner and Romanes)
4. The biological school based on evolutionary doctrine (Lamarck and Darwin)
5. The physiological school with its subdivisions (Sechenov, Pavlov, Bekhterev)
6. The morphological school (Kretchmer)
7. The physical-chemical school (Loeb)
8. Behaviorism (Weller)
9. Pedological schools (Preyer),

and a number of schools of secondary and tertiary importance (the ones above being the main schools).

In the USSR there are representatives of all these schools, and, if anything, they treat each other worse than do the different schools abroad covering the whole gamut of attitudes from an indifferent ignoring of each other to open adversarial attacks.

From the point of view of the history of the development of the science, these facts are completely natural: they can be explained by the intensive development of this science, owing to its widely recognized validity and significance. Similar situations are known in other sciences as well. An important discovery that revolutionizes the prevailing world outlook, or a new method of investigation that makes possible a more fruitful approach to the tasks of science, or, at least, new tasks presented to science by life itself, requiring the efforts of many researchers—all this leads to

differentiation, and, with it, to a more or less deep separatism. This separatism results in bias in research, in the distrust of one school by another and in their struggle, which becomes especially violent among their extreme representatives.

All that, I repeat, is quite natural and understandable. But the students who are to take examinations in these mutually exclusive psychologies would not feel any easier knowing the reasons for this struggle. The students are being torn asunder by the representatives of these schools. Their position is the more difficult because the professors cannot help them out of this difficulty. Presenting in their lectures their point of view on a subject, none of them would undertake a criticism of their comrades which would be negative or condemnatory in character. I speak about materialistic, monistic and dualistic world outlooks *in general*, about conscious and subconscious activities as theoretical constructs, etc. which are followed by the doctrines of the school to which the lecturer belongs. Besides, how can one reconcile his own school with the teachings of others, how can one do away with the disputable and the contradictory—this was left for the students to do themselves, according to their abilities. In the majority of cases they cannot do it. As a result, on their examinations they answer to one professor about consciousness according to classical psychology, that it is a harmful prejudice; and to another that in classical psychology consciousness is the central part of the subject. To one professor the students say that to develop a child's sense of fantasy is harmful, almost criminal, while to the other one, that to develop this psychic ability is necessary; to one they say that the subjective method of studying a subject is antiscientific and cannot yield anything for the understanding of psychology; to the other they say that the study of psychology and its understanding is impossible without this method; to one they say that any collective is a mechanical aggregate, and to the other that this point of view leads not to the understanding of the laws of collective (social) psychology, but to the sociology of dolls, as Lenin expressed once, etc.

If I add to this that the training of the students to be critical of the knowledge given them is poor and sometimes even very poor, it becomes quite evident that a way out of this situation is necessary, both for the representatives of the fighting schools of psychology and, to a greater degree, for the students. This way out may be given certainly only by that discipline of psychology whose fundamentals would be accepted equally by all the schools. It is comparative psychology with the evolutionary method as its foundation that can serve as such a discipline. Only comparative psychology can unite the differing and fighting schools. It can tie their theories together, if not completely, then in that part of their conceptualizations in which the principle of evolutionary doctrine (in the biological sense) can find its application. And, this will be the basis upon which connections may be established among the isolated

disciplines that are acting at present as separate sects. Comparative psychology will give to the student body the very criterion that would help them to understand the contradictions in the knowledge they get, on the basis of biology and its indisputable evolutionary teaching.

However, we have had only one chair of comparative psychology, founded in 1906 at the Psychoneurological Institute, and it was systematically persecuted by the Ministry of Education. After the reorganization of the Psychoneurological Institute, this chair was retained; it existed until 1931, when I stopped giving lectures.

At present, as far as I know, comparative psychology does not exist either as an official faculty chair or even as a subject being a part of the curriculum of any higher educational institution. The absence of this subject in the curriculum of pre-revolutionary Russia is understandable, as is the fact that there the teaching of psychology was permitted on a special request of the University board. This permission was granted only on the mandatory condition that the subject would be taught only to those students who had completed their course in a theological seminar. It is understandable why this subject is absent in Western European universities, e.g., in England, France, Austria, Germany, Spain, Italy, Switzerland, and others which have formal chairs of theology (in some of them there are even two, Catholic and Lutheran, theology chairs or even a theological department). A chair of comparative psychology next to theological chairs would have found itself in a very difficult situation because it is to comparative psychology that we owe the fact that humans, once considered unique in their psychic nature, are considered, not from the psychological point of view, as a link in the long evolutionary chain of the psychic abilities of animals with which humans are inseparably connected.

To comparative psychology we owe the fact that the use of fantasy in interpreting the behavior of humans as individuals and social beings was being methodically diminished and replaced by scientific knowledge. And last, to comparative psychology we owe the fact that traditions, customs and the so-called "basics of life" are purified of all that was introduced to them by ignorance.

I think the foregoing elucidates by itself the significance of comparative psychology with respect both to the student body and to the teaching of different psychological disciplines. At the same time, it makes clear why comparative psychology should be an independent chair in higher educational institutions.

Six or seven years ago, however, I would have thought this proposal useless, if not theoretically, then practically. When I happened to become acquainted with the work of the Psychoneurological Institute in Kharkov, the director of the Institute answered as follows, when I asked him, "Why is there no chair of comparative psychology at the Institute, whereas in the Leningrad Psychoneurological Institute a comparative psychology

chair was founded at the very beginning?" He said: "But where can we find a lecturer for this subject? We have looked, but could not find anyone." And when he asked me if I had anybody in mind whom I could recommend, I had to answer that I did not.

At present things have changed for the better, and I can recommend with good confidence, in the capacity of Docent to this chair, Assistant Professor Dr. B. I. Khotin, whom I mentored for his master's examination in comparative psychology who graduated from the Medical Faculty of the University of Tomsk and is now a physician, who for some time, was my Assistant in Comparative Psychology at the Herzen Institute and was in charge of the Laboratory of the Comparative Psychology Chair. Khotin has published a research in comparative psychology entitled . . . and at present he is working in the Section of Comparative Psychology and Comparative Physiology at the Bekhterev Institute for Brain Research, founded on his initiative and in the formation of which he took part personally.

At the same time, I can also recommend G. S. Roginsky who graduated from Leningrad University, Faculty of Natural History, and then graduated from the Herzen Pedagogical Institute; I was his mentor for the master's degree in comparative psychology, and at present he is a scientific worker dealing with (omissions [. . .] and the abrupt end of the manuscript reflect the state in which it was found.)

BIOLOGICAL PSYCHOLOGY AS A SCIENCE

B.I. Khotin

Nature is the test of dialectics, and it must be said for modern natural science that it has furnished extremely rich and daily increasing materials for this test, and has thus proved that in the last analysis Nature's process is dialectical and not metaphysical.

F. Engels. *Anti-Duhring*

Biopsychology investigates the laws of the origin and development of psychological activity. Its main method is the comparative investigation of different evolutionary stages in the ontogeny and phylogeny of psychological activity. Thus, biopsychology can with full reason be called comparative psychology.

Biopsychology in its essence should serve as a necessary introduction to human psychology, because it reveals the history of prehuman psychological activity without knowledge of which the investigation of human psychological activity cannot be approached. Moreover, the animal roots of its past still survive in human psychology. All the psychological characteristics of animal origin (for instance, instincts) are preserved in humans. They have changed qualitatively but have not disappeared. This heritage from the past should be taken into consideration by the teacher, the physician, and the lawyer, because under certain conditions (most often of a pathological nature) when the ancient clamor of instincts interferes with our modern life, one should be able to foresee it in order to prevent it in time.

More than occasionally, Marx and Engels made excursions into the field of animal psychology. More than occasionally also, Lenin included this science as an indispensable item in the number of dialectical sciences investigating human psychological activity.

Biopsychology has great practical significance in agriculture and hunting. Unfortunately, this young branch of science has not received sufficient attention and the necessity for teaching it in institutions of higher education is not yet obvious to many people. We can understand why in Czarist Russia, the Ministry of Education considered biopsychology a heretical and harmful science. We can also understand why universities of bourgeois countries of present-day Europe and America are ready to

do their best to obscure the question of the animal origin of the "god-like" bourgeois.

To admit biopsychology as a scientific discipline in the universities where theology is taught would be equivalent to suicide for them. Biopsychology certainly can have no place among university departments where the "truths" of capitalist sociology and legal norms are taught to future administrators, ministers, senators, advocates of fascism, and judges of "monkey trials." It is only in the USSR that biopsychology can and must find a place truly equal to that of other sciences, where it can serve the cause of building socialism.

The investigators of the past became interested long ago in the psychological activity of animals, their interests proceeding most often from theological consideration of the godlikeness of human beings. Thus they create an unbridgeable gulf between animal and human psychological activity. Descartes admitted the existence of conscious behavior only in humans, while considering animals to be living machines with wholly automatic behavior.

The 19th century, the heyday of evolutionary doctrine, which expounded the general character of the laws of evolution as they applied to both humans and the rest of the animal world, could not reconcile these views with the metaphysical idea of the gap between the psychological activities of humans and those of animals. Darwin's followers (as well as Darwin himself to some extent) established firmly the principle that humans possess nothing which is lacking in animals. The difference between them, they maintained, is entirely quantitative and not always significant. This was a quite understandable reaction of evolutionary thinkers to the idea of the uniqueness of godlike nature of man. But, as often happens, the evolutionary point of view saw its healthy basis polemized beyond the boundaries of scientific objectivity, and a number of prominent Darwinists became subjectively tendentious. Aiming to construct a bridge between humans and animals they began to discover traits in animals that they had never actually observed themselves and to ascribe to them all the elements of human psychology. This period of subjective comparative psychology was characterized by Wundt in these words: "The only rule we can use judging animal actions is to measure their psychological activity by our own yardstick."

The investigators of this school were guided by the idea that no significant difference exists between human and animal psychological activities, and by their wish to find by any means all the elements of human behavior in the behavior of animals. It is clear that in spite of the valuable achievements of the evolutionary method, the inability of these scientists to explain dialectically the difference between human psychology and animal psychology made them deny the existence of such a difference and led them, as we shall see, to fantastically subjective, unscientific conclusions. In the 1860's Karl and Klaus Vogt, strict evolutionists, in

describing the life of bees, tried to find a distinct governmental organization typical of absolute monarchy. According to these scientists, the words "L'état c'est moi" find their full confirmation in the form of government in the bee colony.

Following this trend, other scientists discovered the republican features in the life of the ant colony. In Romanes' book, "Animal Intelligence," we find many shining examples of what realms of fantasy can be reached under the guidance of the subjective method and analogy with human activities. Professor V. A. Wagner said:

Such scientific works are numerous and varied. At the same time, they resemble each other very much in their manner of description and in their evaluation of data, which bring them close to "fishermen's stories." Some describe crickets (that soon display cannibalism) as altruists of a higher order; others describe spiders as mechanics, beetles as good companions, beavers as rather good physicists, geese as moralists because they have drowned the arrogant peacock on account of his ambitious behavior, and so on.

These examples are enough, he wrote, to demonstrate the nature of this animal psychology based on subjective analogy, *ad hominem*. It is most interesting and instructive that the very same subjective method was used by Wasmann, the Jesuit, who fought Darwinism on behalf of the Catholic church. In his attempt to disprove the evolutionary idea of species development Wasmann described the life of an ant colony and of a beehive and found in their human-like pattern of existence the best confirmation of the wisdom of the Creator who, according to his will, endowed not only humans, but insects too, with mind.

Father Wasmann, presenting a large body of observations on insect life dealt with by the subjective method, stated triumphantly that he had struck down the Darwinian theory. He tried to prove that the living world did not develop from lower forms to higher ones, since the life of bees and ants is no less complex, conscious, moral, and so forth, than that of human beings. Since there is no qualitative difference between animal and human patterns of existence, there is no evolution; there exists only the almighty Creator, who gives according to His will some share of His wisdom to both animals and humans. This is the main sense of the arguments of this Vatican entomologist who used the method of monism (*ad maiorem storiō gloria Dei*, that is, monism "from above").

Although many Darwinists using the same method tried to prove quite the opposite—the triumph of evolutionary ideas—when applied objectively, their observations and conclusions coincide with those of Wasmann the crusader, who was eager according to the Pope's precepts to present all arguments against atheistic Darwinism *ad maiorem gloria Dei* and to the glory of the Catholic church.

As time went on, the objective method of biology won the victory for

Darwinism in spite of the opposition of its crafty enemies in the Church and its "friends" who argued from monism *ad hominem*.

The 19th century, when the natural sciences flourished, provided a different approach to the problem of animal and human psychological activity. Advances in the physiological sciences that proved the existence of differences in structure and function of the nervous system at different stages of evolutionary development, destroyed all the arguments of idealistic monism "from above." The merits and value of this research and of its experimental methods are obvious, as well as the value of the data acquired. It seemed as though the correct solution would come in the near future, but it only seemed so. Materialistic physiologists did not master the dialectical method, and therefore, having crushed "monism from above," they created their own "monism from below," which turned out to be akin to the metaphysical and mechanistic materialism of Fischer and Moleschott, who saw no significant difference between thinking and the secretion of bile by the liver. This is what Loeb, the most prominent and brilliant representative of this school, wrote: "There is essentially no difference at all between a caterpillar feeding and a human being thinking." This scientist could say this because he and his pupils explained the different manifestations of behavior in animals and humans by the presence of tropisms identical to the tropisms of protozoa. All phenomena of life in animals, including humans, were seen not from the angle of determinism, and not in the light of their genetic relationships which would be quite correct but from the view, stated dogmatically, that animals are the same as chemical robots. In doing this they tried to eliminate the qualitative differences which exist between different behavioral and psychological types in animals which belong to different stages of historical development.

We shall not linger over the corrections introduced into Loeb's theory by Jennings, who proved that even protozoan tropisms are not so simple as they may seem. Understanding them requires knowledge of the physiological state of unicellular organisms. It is important to note that Loeb's tropism theory, with certain additions, was quite scientific in general when it was applied to explain protozoan reactions. But it turned out to be thoroughly metaphysical when it was used to reduce all psychological and behavioral phenomena to tropisms and thus represent all living beings, including people, as passive biological automata. And here it is not difficult to realize that some relation exists between "monism from below" and vulgar materialism, which is alien to the dialectical materialism of Marx, Engels and Lenin, their emphasis being on active transformation of the environment, rather than passive compliance and contemplation. The Loeb theory is the best example of the fact that materialism that is not based on the dialectical approach becomes as metaphysical as idealism does.

It is not surprising that the monists "from below" and the monists

"from above" reached the same conclusions in spite of the fact that their points of departure were different. Denying the existence of specific differences between animal and human psychological activity, they both arrived at metaphysics. We may remember that the prominent Darwinist and materialist Haeckel once stated the idea of the "panpsychism" of "atomic souls," and developing this idea logically, stated that, according to his methodology, ants possess a sense of duty in the Christian meaning of this expression as the monistic church understands it. We see the same affecting coincidence in the conclusions of the modern Leduc and the vitalist Lossky, who both arrived at panpsychism. The disciples of both types of monism presented in their dogmatic conclusions a purely imaginary simplicity very remote from true dialectical scientific monism.

The cause of the failure of physiological monism "from below" was, as has already been stated, the fact that the representatives of this trend reduced all behavior of animals and humans to biochemical and physiological processes and went no further. They overlooked thereby the historical path that animals followed from protozoa to human beings, during which they elaborated different types of psychological activity corresponding to different stages of evolution. Biochemical and physiological analyses, although they are capable of producing truly scientific hypotheses of the inner mechanisms of animal reactions, are not capable of explaining the laws of psychological evolution, because such questions are beyond the scope of their investigation.

It is clear that for the scientific solution of the problem of the origin of psychological activity in animals and people the historical method of investigation is required, which alone can demonstrate the main stages of psychological development beginning with the most primitive forms. Important problems are awaiting solution: How can we explain the origin of different types of psychological activity? How can we trace their biological interdependence during development, their relationships with each other?

Comparative psychology (biopsychology) is approaching a solution of these problems. It is capable of elucidating the laws of psychological evolution by means of the historical method.

SOME FINDINGS IN COMPARATIVE PSYCHOLOGY

Basing the evolution of behavior and psychological activity on the excitability of protozoa in the form of various tropisms, biopsychology states that this capacity emerges at the earliest stages of animal existence and has biological significance in three main directions: feeding, reproduction, and self-defense.

These three main paths are the ones along which all further evolution of behavior proceeded, acquiring new forms as the development and increased complexity of the nervous system took place. The initial stage

of the neuromuscular system from the other cells can be seen first in lower *Coelenterata* (*Hydras*). In jellyfish and *Actinia* we see distinct aggregations of nerve cells in the form of the so-called diffuse nervous system. Here too we see that the activity of this diffuse nervous system is manifested in the typical form of a reflex, by which the animal reacts to external stimulation in order to feed or to protect itself. In *Actinia*, we can most distinctly see that the reflex is nothing more than the reactive function of separate body parts not always well coordinated among themselves. The interesting experiments of Pieron, Parker, and Loeb on *Actinia equina* are good examples that enabled Wagner to draw the following conclusion:

Actinia does not react as a whole with the parts of its body, and its reflexes are autonomous. Even in cases when the action of *Actinia* resembles the reaction of the whole organism endowed by psychological unity, as, for example, when the contraction or relaxation of a contraction of the whole body occurs, this unity is only imaginary.

The diffuse nervous system does not enable the organism to act as a united whole. The actions which seem to be coordinated are in fact the result of mechanical summation of a greater or smaller number of separate actions and not the result of activity of a center which organizes the activity of all neuronal systems. . . . Here the activity of animals seems to be a composite rather than a unit.

I shall not cite the data that illustrate these points. Interested readers can find them in many of Wagner's works (volumes I and II of "The Biological Foundations of Comparative Psychology" and other works). Here we are interested only in the fact that a reflex as a reactive function is the result of the dialectical complication of protozoan excitability (tropisms) and is distinctly manifested for the first time in coelenterates.

The further development and complication of the nervous system can be observed in worms. Instead of a diffuse nervous system, we see here a series of ganglia connected with one another by means of a common nerve chain. The number of such ganglia and their corresponding body segments is different in different kinds of worms. According to this number they are subdivided into oligomeric and polymeric groups. For the analysis of further evolution it is important to remember that the polymeric type evolved into the nervous system of *Millipedia*, *Crustacea*, spiders and insects, while the oligomeric type led to development of *tunicata*, *hemichordata* and *vertebrata*.

Thus the diffuse nervous system of coelenterates is transformed in its development into the segmentary ganglionic nervous system of worms. At the same time the complication of reflexes occurs. Instead of the autonomous actions of coelenterates, we have reflexes gradually becoming more complex and creating a new superstructure, a new type of animal reaction (instinct). Instinct, the next stage of development, developed

historically on the basis of complicated reflexes, is a behavioral reaction of the whole animal. It is a psychological category with a number of new, specific characteristics, contrasting with the purely physiological category of reflexes as reactions of separate organs.

The typically complex instincts arise in the course of development. Wagner performed experiments in which he ablated the heads of worms, *Millipedia*, caterpillars, etc. He demonstrated that in these animals there is no clear borderline between complex reflexes and primitive instincts. "After their heads have been ablated and sometimes some thoracic segments as well, they retain some capacity for instinctive activity" (Wagner, "Elementary Psychology").

So far, we still observe the high degree of autonomy of separate groups of segments, each capable of primitive instinctive life. At this stage of development it is still difficult to distinguish an instinct from a complex instinctive reaction. After an animal (*Millipedia*) is cut in two, each of its parts is capable of performing the actions characteristic for the whole animal. In other words, the caudal end of the animal performs trials and "learns" in the same way as the whole animal (Wagner).

It is difficult to establish a distinct borderline here between the reaction of body parts (segments) and the behavioral reaction of the animal as a whole. These animals possess no brain such as is present in vertebrates, without which the behavior of the animal as a whole is inconceivable. As to the head ganglion, owing to sense organs connected with it, it plays only the role of a first among equals. Here we are only at the dawn of the emerging psychological activity characteristic of the highly organized matter of the segmentary nervous system, at the sources of the primary psychological activity (elementary instincts) of worms. Thus it is quite understandable that the essence of the difference between the biological roles of the reflex and of the instinct in these animals is still difficult to find. In order to do so one should compare the most extreme points of the evolutionary stages, for instance the reactions of coelenterates and the behavior of insects, in which, as we know, instincts have developed to their higher limits. Then specificity of the instinct—the behavioral action of the animals as a whole—will be shown quite clearly. At the same time its difference from autonomous reflexes is obvious.

Comparing the life of *Actinia* with that of insects, we see clearly the difference in the biological roles of reflexes and instincts. . . . [The reflex] is always a definite reaction in response to a definite stimulus, and always follows the same pathways. This is why, in reflex activity, we never observe phenomena which are common for instinctive activity; for instance, when worker bees provide different foods for future workers and future females, respectively, that is, when they perform actions which require definite knowledge; although this knowledge may not be individually acquired, it is still real. (Wagner).

The term "knowledge" of course is used here conventionally, only in the sense of ability to perform the series of complicated hereditarily determined actions useful for the species and therefore fixed by natural selection. The term "spontaneity" in describing instinct should be used also conventionally, in contrast to the greater automaticity of reflexes. There is nothing mystical in such "spontaneity"; simply, its mechanism is not yet known.

As they become more complex, the simple reflexes achieve their highest degree of development in the pseudosocial insects (ants, termites, bees). It is characteristic that here development goes through extraordinary phases between its origin and its end result. This was proven in the experiments of Professor Wagner with caterpillars, in which instincts are not so highly developed as in adult insects, but in which the functional antagonism between reflexes and instincts is expressed fairly clearly. The investigator ablated the caterpillar's head and found that in the animal deprived of the head ganglion, the organ which controls predominantly instinctive activity, the reflexes changed dramatically: in response to tactile stimulation, the head-ablated animal developed, instead of a single movement of self-defense (as in the normal condition) a series of reflex movements which continued (because of the elimination of the inhibition effect of instincts) for a long time after the cessation of stimulation, up to total muscular exhaustion without any biological gain. This type of interaction between reflexes and instincts in the evolution of behavior has great biological significance.

Professor Wagner concluded his experiments thus: "Instincts are antagonists of reflex activity, which they can inhibit in certain cases and up to certain limits; they control and govern reflex activity the more noticeably, the higher the organism is in the scale of progressive development of instinctive abilities." The biological usefulness of such relationships, fixed in the course of natural selection, permits the animal to expend its efforts, not to the point of exhaustion, but only to the extent to which it is affected in response to noxious or useful agents.

THE CHARACTERISTICS OF INSTINCTS

It is typical of instincts that within certain limits they are unerring and match their biological tasks perfectly, but as soon as the habitual environment changes the old instincts become quite senseless and useless for the new conditions. Thus the young sazan (fish of the carp family) instinctively stay in the mouths of rivers. As these places become more and more shallow, the fish begin to die, because their instinct still holds them there. Only those few will be saved that will develop new instincts which will help them to shift into new, deeper places (Wagner).

Biopsychology subdivides all instinctive activity into three main groups: the instincts of feeding, of reproduction and of self-preservation. Of

course, this classification, like any classification, is to a certain extent arbitrary; animals never possess these instincts in isolated form. In general, a complicated system of interactions of these instincts exists, with one instinct predominating at a particular moment. When the animal is hungry, the instinct of self-preservation is inhibited and the animal rushes towards its prey, abandoning its usual caution, and frequently can be snared by a hidden trap.

At particular seasons the reproductive instinct inhibits the feeding instinct as well as the instinct of self-preservation. Furious fights occur at these times between males in order to win the female. Animals that usually are very cautious fight each other in open places, paying no attention whatever to potential danger and forgetting hunger. Most often it is the instinct of self-preservation that dominates all animal behavior. Such a complicated phenomenon as parental care, which always impresses the anthropomorphists such as Brehm, at the same time include cases when the mother eats the offspring or when the offspring eats the mother, as with several spider species.

If the infant animal is very young the mother sometimes sacrifices herself and perishes defending it or distracting the attention of the enemy. But when the cub has grown a little, the mother often abandons it in case of danger, leaving it to itself, sometimes dooming it to death. Here the decisive factor is not maternal love but natural selection, which, obeying the law of benefit to the species, regulates the interrelation between the instincts of self-preservation and reproduction.

We happened to observe maternal behavior in shore bird colonies near Murmansk and Novaya Zemlya. Maternal care changed gradually, day by day, as the chick was growing. The bigger and more independent the chick became, the less attention was paid to it by the mother. During the first days of the chick's life, the female guillemot did not leave it even for a little distance, even when the . . . (by fluctuation, or variation) or by means of sudden mutational emergence of sharply different new features (see Wagner's *Comparative Psychology*, I and II, and his *Studies in Comparative Psychology*, No. 3). . . . The whole evolution of instincts is possible only because of this peculiar species-specific plasticity of deviations from the main type which are independent of individual experience.

The unchangeability of instinct is also as relative as the stability of species (Wagner). Within the stable species pattern of instinct, fluctuations in an opposite direction always take place. Only owing to this unity of opposites—pattern of stability and pattern of fluctuation—is the development of new forms of instinct possible.

Each phenomenon needs to be defined. It is difficult to define instinct briefly, because of the complexity of the phenomenon; because of this, psychology is accused of devising overlong definitions. Several attempts to define instincts in a few words have obviously failed (Spencer, Lloyd

Morgan, Ben, Gross, Ziegler). The most appropriate, in spite of its newness, and the most correct, seems to be "Instinct is species knowledge in animals." The very term "species knowledge" implies, of course, its difference from individual knowledge. At the same time, this definition emphasizes that in instinctive activity there are, objectively, results of which the individual animal is not aware, but which are biologically indispensable for species development. Examples which prove the correctness of the view of instinct as species knowledge or species experience are numerous. Several are given below.

The larva of the rhinoceros beetle constructs a cocoon which is greater in dimensions than its own body, but which fits the body size of the future imago, knowledge which the larva could certainly not possess (as even the most ardent anthropomorphists must admit). A cocoon of the same size as the larva itself would imperil the future imago because of the latter's greater size, and therefore would imperil the survival of the whole species.

The domestically raised young beaver tries to construct a dam in its cage using twigs, without any special learning, as if anticipating the vital need for this construction in its natural habitat.

A young bird of a migratory species incubated in captivity and absolutely tame tries unsuccessfully to leave the cage in autumn, at the time of migration, in an attempt to join the migrating conspecifics that it has never seen. In the wild the migratory instinct acts providentially to exchange the summer habitat for a new one long before the winter cold arrives.

All these examples demonstrate that animal instinctive activity proceeds without any individual learning. The same case is true of a bee, which first constructs a cell of wax, then fills it with honey, and only after that lays an egg in the cell. The honey supply is made providentially by the bee for its future progeny, without any sign of individual experience or imitation.

THE CONTENT OF THE NOTION OF INSTINCT

From ancient times to the present, metaphysical philosophers have tried to distort the notion of instinct and to introduce into it some mystical sense of "the wisdom of the Creator." The idealists do such things very well! At the same time it is absolutely clear that biopsychology is by no means responsible for such a falsification of the notion of instinct, a notion which is purely biological. Professor Wagner, who is one of the most qualified experts in the biology of instinctive phenomena wrote: "The seeming mystery of instinct is in fact the mystery of our ignorance." Metaphysicists take advantage of the ignorance of average, educated people, obscuring the scientific investigation of instinctive phenomena with religious and philosophical mist.

Professor Wagner names as one of many instances exposing "the wisdom of the Creator" the construction of swallows' nests. Investigating the nest building activity of swallows, using his biopsychological method, he found that several nests had special foundations that gave them exceptional firmness. This fact, a shining example of biological adaptability, moves to tears the sentimental metaphysicists who believe that it was the Creator who in His wisdom endowed swallows with the ability to fabricate their nests so expediently. But detailed biopsychological analysis of this case reveals quite another explanation of this phenomenon. It appears that this foundation, so well adapted to its purpose, was elaborated as the result of the failure of very many less well adapted nests which were thrown down by winds. Here too, occurred natural selection, almost before the observer's eyes. Mechanically, from year to year, by mercilessly destroying all nests which were of nonadaptable type, natural selection established the type of construction that would serve as the safest home for this species of swallows and its young. Apparently, "the miracle of the wisdom of the merciful Creator," that so strongly moves the learned mysticists had every year arranged a bloody purge of less suitable variations in order that a few young birds would be raised in the adaptive type of nest. Biopsychology produced many such demonstrations. Instinct appears to be no more miraculous than protective coloration or other types of ecological adaptations in various animals. But, in cases of abrupt environmental change or in human-made conditions, instinct became pointless and even destructive owing to its very slowly changing nature. "The miracle of the wisdom of the Creator," that taught the squirrel to bury nuts in the autumn, reveals its total natural futility when the squirrel attempts to bury the nuts under the carpet in a room. But this instinct, useful for the squirrel in the natural environment, was formed by means of natural selection of useful behavioral elements.

No animal learns an instinct. It is born with it, being able to perform a number of extremely complicated actions vitally useful in its natural habitat. A young bumblebee first out of its pupa has never seen the process of cell construction, but still can do it no less perfectly than an old one. Young buzzards are capable of distinguishing a venomous snake from a nonvenomous one in a flash, without any previous learning and without having seen a single snake before, while people often mistake snakes in spite of all their knowledge. Carrier pigeons fly straight to the spot from which they were taken after being transported hundreds of miles in an unknown direction in a closed basket. Nobody taught them this art; they were hatched from the egg with it, therefore they perform it instinctively. The seasonal migration of birds, as well as the most complicated constructions of beavers, are made by instinct. All this animals do without any individual learning (newly born animals doing as well as older ones). All these instinctive skills emerged automatically at

the cost of the lives of myriads of living creatures that did not possess instincts sufficiently adapted to these conditions.

So biopsychology has provided a scientific answer to the problem of this seeming miracle by stating that "here we have an excellent example of the mode of origin and development of instincts suggested by Darwin; that is, the gradual accumulation of useful characteristics developed in various directions without conscious participation (without awareness of purpose), and fixed in that direction by natural selection, which were useful for the species in its struggle for existence" (Wagner).

The evolution of intellectual abilities in animals, the bifurcation of the ancestral worm group into oligomera and polymera gave birth to different patterns of further psychological development: in the continuum from polymerous worms to higher insects we can see the increasing complexity of instincts and a very feeble development of individually acquired behavior. The entire body of facts relating to insect learning and training proved to be either imprecisely described or subjectively explained. In fact, higher insects are capable only of instinctive spatial and mosaic-object memory. At the same time, in chordates possessing less developed instinctive reactions (in comparison with arthropods) we can see the highest level of development of behavior and intellectual ability based on individual experience which is finally transformed only in humans into a new, purposeful ability to make artificial tools and to connect sounds into articulated speech. Intentionally, we do not touch here on this special question.

One of many purely biopsychological proofs pointing to bifurcation in the evolution of psychological activity (Figure 1), rather than to a straight course of development as is supposed by certain scientists (Figure 1, B1 and B2), are the facts showing that, for instance, in fishes in which we observe the emergence of truly *individually* acquired behavior (Möbius, Goldschmidt, Hamburger, Wolf, Frolov and Khotin), the instinctive life is infinitely simpler and less well developed than in insects.

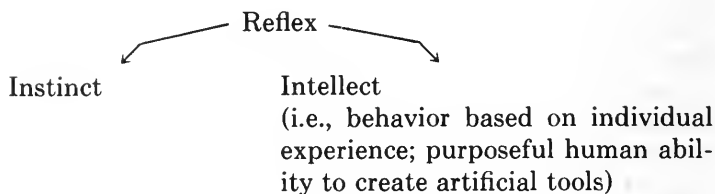
It is clear from these facts that behavior based on individual experience is not the result of a complication of instinct, but that both instincts and intellectual abilities in animals developed from a common basis, that is, from reflexes, with the rate of development differing in different evolutionary branches. Of course, we see the presence of instincts in vertebrates as well, but they do not achieve the same complexity as in arthropods (for example, in insects).

Behavior is based on individually acquired experience developed out of dialectically complicated reflexes; and it stands in contradiction to reflexes, as also do instincts. The proof of this is in the facts of biopsychology, as well as in the following facts from the field of neuropathology (the school of Professor M. I. Astvatsaturov). The activity of the cortex of the brain (the organ of individually acquired behavior), which is the most recent evolutionary achievement, inhibits and controls the reflex

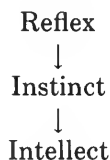
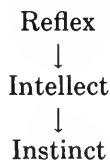
Development of Psychological Activity

Scheme A

Wagner



Scheme B

A. *Spencer and Darwin*B. *Lewis and Pouchet*

activity of the segmentary levels. This antagonistic “contradictiveness” in the activity of the segmentary levels is revealed most clearly in cases of pathological processes in the cortex and its efferent (pyramidal) tracts. In such cases, when the inhibitory activity of one of the pair of antagonists is switched off, the activity of the other antagonist, that is, the reflex activity of the segmentary structures, increases. At the same time, the most phyletically ancient pathological reflexes begin to appear. These reflexes, such as the grasping reflex of the foot (Babinski and Rossolimo reflexes) were once biologically useful to our tree-climbing, four-handed ancestors, but lost their biological significance in the course of the evolutionary acquisition of erect posture by humans. The child is born with these old reflexes, but by the time of the emergence of upright posture they became inhibited, and in the healthy adult are not seen at all. The antagonism between the activity of the spinal cord and the brain cortex, related evolutionarily with each other, is revealed when the latter is damaged. Then “the beast of the abyss of the past” roars threateningly. The dead grasp the living only when the latter lose their strength.

Having thus elucidated the genetic relationship between the reflex and the intellect (individual experience) in animals, let us see now what is the nature and what are the limits of this animal intelligence and where lies the fundamental principal difference between it and conscious (purposeful) human activity.

Most physiologists consider an animal to be a living machine that functions only on the basis of unconditioned and conditioned chain reflexes. Thorndike’s theory of the chain of associations is close to this

mechanistic view of individual learning. On the other hand, the anthropomorphists—Romanes, Espinas, LeTourneau, and others—humanize animals completely. Both points of view are equally alien to biopsychology. Its historical method of investigation adduces a number of facts and observations that prove that animals are not machines operated by reflexes. At the same time biopsychology demonstrates that all the statements of anthropomorphists about “clever dogs,” “horse mathematicians,” or “ape geniuses” are based on old wives’ tales about their exceptionally clever animals or on observations of the results of expert training by circus performers. Their tricks do credit to their skill, but they do no credit to the credulous spectators who take all these cases for scientific proof of animal intellect.

Here are some facts from biopsychological materials on this subject. A bee has constructed a wax cell and begins to fill it with honey. If the experimenter destroys the bottom of the cell so that the honey flows out, the bee, even while aware of this, continues to fill the cell, and the honey will keep flowing out. What is more, a little later the bee will put its egg into the cell and will seal it up in the empty cell, leaving the future larva to starve. Another example: A bird lays an egg in the nest; the experimenter removes half of the nest, including its bottom. The egg inevitably falls through and breaks. But the bird, seeing all this, will proceed nevertheless to lay eggs one by one in the nest, which will all fall to the earth before its eyes and break. Where is the “architect’s and builder’s” understanding of the goal in such cases?

I happened to observe a cow that “learned” to open the gate in the yard. The cow rubbed its horns against various other objects in the yard, according to its usual custom. During the rubbing movements against the gate, the latch occasionally opened and the animal gained its freedom. After that, the cow always came up to the gate and made the same rubbing movements, thus opening it. It is clear that there was no purposeful use of the latch as a tool here, but that the cow succeeded in opening the gate, owing to the fortuitous association by contiguity between the lifting of the latch and the series of rubbing movements. The similarity of these actions to those of a human being of using tools is only illusory. The owner of the cow was of another opinion. She was absolutely certain of her cow’s human intellect and was quite offended by my doubts in this respect.

Lubbock taught his “outstandingly clever” dog to choose from many others the plate with the word FOOD on it, reinforcing this choice by feeding. Here the same type of association by contiguity took place between the food and the olfactory and visual stimulation from the plate. But this enabled some people to be enthusiastic about the dog’s “ability to read.” At the same time Lubbock was unable to train this dog in arithmetic. After long and fruitless efforts, he stated that “he was disappointed by the dog’s inability to distinguish even one stripe from

three." Yerkes analyzed the behavior of one other rather famous dog, Roger, who played cards, wrote words and solved arithmetic problems. After careful analysis, he concluded that this dog had been trained to catch the subtle (intended or involuntary) movements of its owner's hands, eyes, and head. They were not always noticeable to people, but represented a rather easy task for the sharp eye of the dog. The same must be said about horses—various "clever Hanses," "Emirs" and other bread winners of the circus ring. Morgan shares this opinion. Kineman while observing the life of caged macaques saw that they succeeded in opening the cage door by means of random manipulations. But he did not discover any special purposefulness, no wish to be free, in their activity.

During my experimental work on imitative behavior in rhesus monkeys in the Leningrad Zoo I often observed incidentally something that clearly demonstrates the absence of any purposefulness in these animals. The monkeys were trained to open the cover of their food bowl and to take grapes from it. Very soon they began to do it without a mistake. But once one of the animals sat on the cover, and I saw that it tried, unsuccessfully of course, to remove the cover while sitting on it. This animal, as well as those who were near it, could not understand the correct sequence—first, to free the cover of its body weight and only then to remove it. They went without getting food although, I repeat, they had removed this cover a hundred times before.

The special experiments with chimpanzees performed by N. A. Ladygina-Kots in Moscow and the German Professor Koehler in the Tenerife station seem to me to be the most interesting. Ladygina-Kots observed the behavior of chimpanzees performing numerous experiments. Though she somewhat overestimated their abilities, she nevertheless had to admit that their abstractions "were not abstractions in the strict sense of the word, since they were *not* the result of a logical operation based on the formation of ideas and on formal inferences about the essence of the process."

Professor Koehler described in his extensive work several actions of chimpanzees bearing an outward resemblance to the capacity for tool-using and even tool-making. While we acknowledge the great value of these data we disagree with the author in the conclusions he drew from them. Detailed analysis showed that although these actions really had taken place, they were accompanied by such a great number of absurd and purposeless actions of the animal as to compel denial of any possibility of speaking, even with reservations, of the chimpanzee's capacity for "abstractions" as well as for tool-using and manufacturing. Chimpanzee behavior bears only an apparent resemblance to human conscious activity. In their essence the two are as different as the paths of their historical development.

It is not to be forgotten that the human capacity to use tools, and especially to manufacture artificial tools, as well as the capacity for articulated speech, appeared in humans as late as the dawn of their history. This dawn, evidently, never shone for the ancestors of anthropoid apes (because of their specific developmental conditions) and it will never shine for them. The attempts of certain amateurs, "a la Brehm," to look for speech in apes are futile. Of course, primates, as well as many other animals, are capable of using their own "language"—specially modulated sounds—in order to communicate with one another, which we also noticed in our observations of monkey behavior. But this capacity should in no way be compared with the most primitive human purposeful speech, just as the activity of a chimpanzee in joining two sticks together (the accidental end result of numerous inborn nonpurposeful actions) should not be compared with the conscious, if primitive, creative ability of cave dwelling peoples when they manufactured "the crudest stone knife" (as Engels noted).

Because of this it seems to us that those scientists who consider, after studying apes objectively, that they are quite incapable of even elementary thinking, more nearly approach the truth than those like Yerkes who ascribe reason to apes, seeing in their behavior some capacity for "ideation." Admitting that apes occupy the highest position in animal classification, the former scientists still believe that the "summit" achieved by apes cannot be compared with that obtained by humans.

At the same time serious attention should be paid to the views of Leshley, Koffka, Adams, Tolman and Higginson concerning the complexity of the animal's learning process and its nonautomatic nature. What is the explanation of conscious psychological activity in humans, which developed historically from psychological activity in animals?

The human capacity for purposeful and deliberate manufacture and use of artificial tools, as well as the capacity for articulated speech, are the qualities which make humans different from all other animals.

They are all the results of the effortful activity of human ancestors which led to the highest development of the neuromuscular structure of the upper extremities and to the development of brain and language. Thus, the capacity for purposeful acts of work and for speech function are of course, not quite gifts "from above," but represent the next stage in the dialectical evolution of behavior based on individual experience in the conditions of the process of labor.

This capacity, which arose in circumstances that are not yet known to us exactly, enabled humans to modify their environment, adapting it to their needs by means of active, planned action.

The principal difference between human processes of work and animal behavior was noted long ago. Marx and Engels also paid attention to this specifically human capacity. Concluding his well-known example relating

to the activities of the bee and the architect, Marx wrote: "Man is the only one who possesses the following 'simple moments' characteristic of the process of labour: goal-directed activity (that is, labor per se), the object of labor and the means of labor."

Engels, stressing the purely human purposeful quality of labor, noted that "no ape had ever made even the crudest stone knife with its paw."

Biopsychology also states that there is nothing supernatural in the origin of the human capacity for conscious purposefulness; there is also no impassable gulf between this capacity and the activity of individual experience in all other animals. Still, purposeful activity is characteristic of humans, and of no other creatures because "labor created man" (Engels).

Certain physiologists (Savich, Frolov) and jurists (Petrzhitsky and others) do not agree with this. They try to invalidate the assumption of human purposefulness as one of the main criteria of human thinking.

Professor Savich points to Don Quixote's battle with the windmills as an example of nonpurposeful activity. Professor Petrzhitsky states that in everyday life our speech contains many phrases and expressions that are meaningless. He gives as an example characterization of a negative act as "foul," or "criminal," spoken with full knowledge of their meaning, but without intending prosecution. These words are uttered "because" rather than "in order to."

We consider these objections to be without merit. The tragicomic and ridiculous actions of Don Quixote did not at all lack goal understanding, in spite of their actual absurdity. Don Quixote knew what he wanted to do and for what goals he acted. But he could not discriminate between the objects of his banal surroundings and the ideal images that were in his honest but half-mad brain.

If all the actions we perform were always appropriate to actual circumstances, we would never make any errors. But even while learning through error we visualize our goal quite distinctly. Only because of that, we are able, gradually correcting our mistakes, to approach the goal, which is always conceptually present in us at the beginning of any work.

Petrzhitsky's argument that we perform a large number of habitual actions and utter habitual phrases without understanding their intent is also unconvincing because a habitual action could have become habitual only because it was first performed with full understanding and according to a planned goal. Shaving with an axe cannot, under usual conditions, become an habitual action of a mentally healthy man. But, while performing a habitual task, we act as if we had forgotten the goal that we had clearly in mind originally and used to think over in detail. If we recall a series of habitual greetings and oaths we shall realize that they were once intended literally and were accompanied by appropriate purposeful actions.

The expression "Be well" (Russian for "How do you do") was once a

real wish for good health and strength; "Always at your service" at the end of a letter was not always as trite as it is now. At one time, a person who used such a phrase was truly expressing deep devotion.

Professor Wagner, discussing the difference between animal intelligence (the behavior of individual experience) and human activity, correctly emphasizes that in the latter purposefulness is a factor "if not always an actuality, always a possibility," while animals lack this very capacity. The capacity for individually acquired behavior was transformed in humans, in the course of dialectical evolution, into the capacity for goal understanding.

Some stages of such transformation can be seen in analyzing child behavior. At first, when the child has no understanding of the purpose and convenience of a fork, it takes the food up with its hand, which seems to be easier; but remembering its parents' bidding to use a fork, it spears the food on the fork with its hand, and only then carries it to its mouth. Understanding of the greater convenience in civilized conditions of using a fork is acquired only gradually. Sometimes the child tries to eat soup with a spoon using the convex side, naturally achieving no result. But at a certain age the spoon begins to be used correctly, the goal being understood, and such mistakes are never made again.

Nineteenth century travelers described more than one occasion when natives of Central Africa, given rifles for the first time, and knowing their effectiveness, still used them for a long time as sticks while marching and for knocking down fruit from trees. But "brain capacity" as a morphophysiological precondition for purposeful activity is clearly present in them, as in Europeans when they act in appropriate situations.

This is why the fascist theory of the biological inferiority of psychological activity in colonial peoples, in comparison with those of the "noble" races, can stand no scientific criticism. It is characteristic that bourgeois ideology revealed the face of its class in both cases—in monism from "above" of the social Darwinists and the monism "from below" of mechanistic physiologists who tried to explain human social life by means of the theory of tropisms (Waschweller), the theory of reflexes of freedom and goal (Pavlov, Savich), or the theory of collective reflexology (Bechterev).

Marx and Engels remarked long ago that it is inadmissible to apply biological laws to human social life. They justifiably reproached Darwin, first for extrapolating Malthus' law from bourgeois sociology to the animal world, and second, for applying in the same way the idea of the biological struggle for existence to human society. The organic school of Spencer (Worms and Lilienfeld), and social Darwinism, beginning with Haeckel and ending with modern fascist social theories of the "animal-like psychology of the colored and inferior races incapable of abstract thinking," try to justify the colonial policy of capitalist violence.

THE PRACTICAL SIGNIFICANCE OF BIOLOGICAL PSYCHOLOGY

Let us discuss the applications of biopsychology. From prehistoric times to the present day people have always been interested in the psychological activity of animals.

Each day in the life of primitive humans was a day of furious struggle for existence. They had to fight to obtain food and to avoid predators. They had to know the habits of the beasts they hunted, as well as those of the beasts who hunted them. It was a time of continuous fierce struggle against animals for food and life itself. The death of the conquered secured life for the conqueror. The primitive fisherman struggling for food had to know the habits of local fishes, the places where they gathered, the place and time of spawning, the best kind of bait, and similar matters.

The primitive hunter had to know the habits of different animals in order to read their traces on the snow and on the ground and to counter their caution. He had to know their route to the water, the places where they rested and made their homes, and the degree of development of their senses of sight, smell and hearing. Without such knowledge his life was in danger. Knowledge of these distinctive characteristics enabled him to elaborate different patterns of hunting and self-defense.

At that time torches and flints attached to bones were the only weapons known to *Homo sapiens*, who was physically weak in comparison with the giant predators of those times.

As a result of the collective labors of primitive people, empirical knowledge of animal psychological activity was gradually accumulated, helping them to win in the struggle against the teeth and claws of their enemies. "The dark wisdom" of animal instinct was conquered by collective human knowledge.

An acquaintance with animal psychology also was necessary for humans in the period when they tamed and domesticated wild animals. For domestication, which formed the basis of cattle breeding and later for development of new breeds, a knowledge of the behavioral characteristics of the animals was indispensable.

Thus, during tens of thousands of years, humanity learned to accumulate empirical knowledge of animal psychology, because the rigorous mode of existence required such knowledge. It was a centuries-long learning process.

But the real science of animal psychology was not yet born. For a long time scientists studied anatomy and physiology describing in detail the structure and functions of the animal body. Zoology was studied, but established science was not interested in the psychology of animals. Only after the work of Lamarck and Darwin did the problems of animal behavior begin to be considered, but for a long time still the correct evolutionary historical method was not elaborated.

Then, about 35 years ago, our Russian scientist, Professor Wagner,

laid the foundation of historical biopsychology, on the problems of which he worked until the end of his life. Nevertheless, the majority of scientists paid very little attention to the problems of biopsychology.

At the present time, when the different sciences are organized according to social, practical needs, the process of socialist construction came close to the problems of cattle breeding, fisheries and rational hunting. A variety of old questions arose again: when, where and how to fish best and to hunt animals most effectively, what bait and tools should be used; how to prevent extinction and how to breed different kinds of fish and other animals.

Hunters and dog breeders became interested in establishing the most effective methods of training dogs (quite empirical by the present times). The question arises whether it is possible to organize a special zoopsychological laboratory to carry out selection of dogs for hunting, searching, military, medical and fire fighting purposes, as well as to investigate which breeds of dogs can be most easily trained for each specific purpose.

Carrier pigeons, which were widely used as the living wireless telegraph of the Red Army, and cavalry horses are still awaiting biopsychological investigation. Every cavalryman must know the psychological peculiarities of his own horse, as well as the group behavior of the whole herd, especially because of the possibility of sudden panic.

Our peasants have been paying a quit rent (wolf-tax) since ancient times. Hundreds of thousands of cattle are destroyed by wolves yearly. We still do not know how to remedy the situation radically. In North America wolves have been totally eradicated. It was accomplished only because, after study of the habits of wolves, it became possible to proceed to their mass extermination. Rats consume annually about one million rubles' worth of food. The task of constructing suitable storehouses for foodstuffs should begin with learning about these crafty animals.

The struggle against predators and pests, including locusts, can be successful only when their instincts are better understood. In order to conquer an enemy it must be studied, its psychology must be known. It is biopsychology that can give us this knowledge by investigating the instincts of self-preservation, feeding and reproduction; methods of defense; various habits; nest building; maternal care; social behavior; intellect; and imitative ability of animals, and the like.

THE BIOLOGICAL METHOD OF OBSERVATION IN COMPARATIVE PSYCHOLOGY

In contrast to the method of the anthropomorphists and to the pseudo-objective method of the mechanists, who tend to make a fetish of the experimental method and deny the scientific value of observation, biopsychology perceives observation to be one of its chief methods. The essence of this method is the study of problems of psychological activity in the

course of their development from lower to higher forms. This method includes three stages of analysis.

The first stage is the investigation of the phylogeny of a psychological phenomenon. The basis of this analysis lies in the objective comparative investigation of facts concerning the species, genus, family, and so forth. Darwin's study of the evolution of nest-building behavior in birds can serve as an example. He began his analysis with birds that do not build nests but lay their eggs among stones or in a heap of putrefying leaves (*Talegalla lathami*); then he shifted to elementary nest-building and finally he analyzed very complicated communal nests—those of weaver birds. Darwin used the same method in the analysis of the building instinct. He traced its evolution from the elementary building instinct of the bumblebee, through the intermediate phase of cell making in Mexican *Melipona domestica* up to the most complex building activity in honeybees, the construction of wax cells.

The second stage is ontogenetic investigation of psychological events made on the basis of comparison of different facts of an individual's life. Wagner's investigation of age characteristics of spider instincts can serve as an example. The change in patterns of hole construction in tarantulas clearly demonstrates the ontogenetic development in their building instinct.

The third stage of the biological method is the synthesis of data obtained during phylogenetic and ontogenetic studies of psychological activity. Professor Wagner indicates that ontogenetic evolution in the young tarantula's building instinct recapitulates in many details the evolution of this activity in the spider family. "At first it [the nest] is an occasional hole in the ground; then a small artificial hole, then a still crude horizontal hole; and finally a vertical hole of specific length." He gives numerous examples of such recapitulation of phylogeny in ontogeny, but, concluding this series, he warns against the crude identification, as well as confusion of these two different categories of the evolutionary process, stressing that there are specific distinguishing features in phylogeny (paleogenetic) and in ontogeny (cenogenetic).

METHODS OF BIOLOGICAL AND PHYSIOLOGICAL EXPERIMENTATION

Observation and experimentation are two different methods of investigating nature, each possessing strong and weak features. Observation, producing rich material by studying phenomena in natural conditions, does not permit the observer to intervene actively in these processes and thus to test them by experience. On the other hand, the usual experiment permits us to intervene actively in the processes and to test them in artificial laboratory conditions. At the same time, however, it often prevents the experimenter from discovering the laws of the same processes

as they occur in nature. Thus, it is not surprising that experimental psychological data quite adequate for describing the process under laboratory conditions prove to be inadequate or even in opposition to those obtained by observation in the natural environment. In studying animal psychological activity the experimental method is traditionally used in parallel with observation. Training, problem boxes, method of multiple choice, maze learning—these laboratory techniques possess not only positive, but also negative features of the experiment, such as isolation of animals from the natural environment and sometimes distortion of their psychological activity in the laboratory, as against natural conditions. Fabre and other scientists, in their study of instincts, used the method of observation with only minimal attempts at experimental interference into manifestations of instincts in insects. Professor Wagner having made comprehensive use, on his side, of the observation of nature, (see his work "The Technique of Animal Observation"), used, also, the method of biological experimentation in studying psychological activity in animals (insects, spiders, worms).

One of the main features of biological, as distinct from psychological, experimentation, consists in the possibility of bringing the conditions of the experiment close to those of the natural habitat. The best example of this method is Professor Wagner's interpretation of the flight of bumblebees through the window of his room to their nests. In this investigation the marked insects, living under conditions close to natural ones, enabled the experimenter to change actively the conditions of the start of flight and return to the nest. This allowed him to demonstrate the mosaic pattern and spatial character of their memory. I believe that this still new and little-known method of biological experimentation should become one of the most important ones, equally with the method of observation in comparative psychology.

At the same time physiological experimentation (including extirpation of various parts of the brain) can also have a place in solving the above mentioned problems in animal behavior. Comparative investigations of normal and decapitated segmented animals and insects, though to a certain extent passing beyond the boundaries of pure biological experiment, enabled Professor Wagner to find out that the ablation of the head ganglion by means of ligature or partial damage (in worms, leech, *Milipedia*, cockroaches and several species of higher insects) induces far less change in normal behavior than occurs when the brain is damaged in vertebrates, especially in higher ones. Hence, a conclusion was made concerning qualitative differences between the processes of ganglionic and central nervous systems (Wagner, "Segmentary Psychology").

In our studies of bird colonies on the shores of Murmansk and Novaya Zemlya, in addition to observation, we used the method of biological experimentation and obtained a number of interesting data on the psychological activity of guillemots and kittiwakes.

As a rule, physiological experimentation reveals the laws of the functions of organs and organ systems under more or less artificial conditions, while biological experimentation reveals the interactions of organisms within the environment and with one another in natural habitats. Consequently, these two methods, together with the method of observation, each investigating its respective field of phenomena, do not exclude, but complement one another in a comprehensive investigation of animal psychological activity.

CONCLUSION

In my concluding remarks it is worthwhile to emphasize the essence of the historical method of comparative psychology. This method asserts, first, the continuous variability in the forms of animal behavior and psychological activity, and, second, their saltatory development. Historical development of various forms of psychological activity proceeds by means of quantitative and structural complication of one typical quality being transformed into another.

In our day the advances of the physiological sciences, especially the science of the physiology of higher nervous activity led by Academician Pavlov, have encouraged certain representatives of this school to consider their physiological method to be universal, all-embracing, and to draw erroneous, crudely materialistic conclusions in biology and even sociology. Metaphysical materialism, inadequate even at the time of its origin, is still more inadequate now in its attempts to adequately interpret the biological problems of psychological evolution, not to mention its complete inadequacy in the field of sociology.

The valuable discoveries of the physiological school of Pavlov, as well as those of the biochemical school of Loeb, speak for themselves. Their great significance in achieving understanding of the mechanisms of behavior is truly indisputable. They have given something and promise to give still more within this field. Especially important are their achievements as a weapon against the newest forms of disguised vitalism. At the same time, the tendency of several scientists of these schools to neglect *historical investigation of the evolutionary laws of behavior and psychological development* in favor of chemical and physiological methods of investigation is more naive than was the materialism of Buchner and Moleschott. The time for loud mouthed, superficial, simplistic generalizations has passed. Now it is necessary to combat the assaults of disguised idealism in biology from the right and at the same time to avoid a shift to the left, "left childishness," that is, the new mechanistic tendencies which appear in the form of physiological assertions denying the existence of psychological activity in animals and the validity of biological psychology as a science. Such tendencies really do exist, and not only abroad (Loeb, Baer, Boete, Uexküll, Ziegler, Neel, and the

American behaviorists). Due to such presumptions, physiologists often deny the existence of biopsychology (comparative psychology) as an independent science with its own objective methods of onto- and phylogenetic observation and biological experiment.

The main methodological error of the point of view mentioned above is the mechanistically simplified reduction of complicated phenomena in animal psychological evolution to physiological mechanisms. One of the examples of this is the attitude of the majority of physiologists toward the question of instinct. Some of them are afraid even of the term "instinct." The main trouble is that they know too little about the biology of instinctive activity, and thus it is difficult for them to evaluate to a full degree the significance of the scientific biopsychological investigation of instinctive reactions as a type of behavior. It is true that recently certain physiologists have appeared who want to approach the analysis of behavior not from the standpoint of its mechanisms but from the standpoint of general biological evolutionary study; but they are forced to conclude that to solve this problem the investigation of instinctive behavior as such is necessary. Their fear of the concept of instinct is gradually receding.

I have not touched here on the special problem of the mechanisms of instinct phenomena because it pertains rather to the field of comparative physiology of the nervous system. As was mentioned above, we are interested here in the biological laws of the development of different types of behavior. Even if it had been proved experimentally that the mechanism of instinctive acts is nothing else than a chain of unconditioned reflexes (Pavlov, Savich, Frolov), or is formed on the basis of the humoral dominance of certain endocrine glands (Vassiliev)—even then, the knowledge of the physiological mechanisms alone would help little in the investigation of *biological evolution*.

The experiments of Professor Beritov's school, using the technique of "free movements" are of extreme interest (*Fisiol. Journal*, 1934, nos. 2, 3, 4). Having for several years studied the physiology of the central nervous system by means of conditioned reflexes, Professor Beritov concluded that this physiological method is "absolutely inadequate for the study of animal behavior," and that "the laws of reflex activity cannot be applied to behavior." This scientist drew these conclusions on the basis of numerous facts brought to light by his experimental work.

Beritov contrasts individual "conditioned" reflexes of an animal connected to a special device in an experimental chamber with the individually acquired behavior of an animal ranging freely, considering them to be different in principle. He gives a series of convincing examples and states, "We often face such individually acquired reactions that can by no means be considered as being performed automatically, according to the 'signal-response' rule." From this he concludes that "behavioral science should possess its own techniques of investigation in accordance

with the character of its subject (and in contrast to the study of conditioned reflex mechanisms)."

Basing our opinion on the data of biological psychology, we fully agree with these considerations of physiologist Professor Beritov. At the same time, we do not hide our fundamental disagreement with him on his suggestion concerning the existence of "purposefulness" in animals. We think that this erroneous suggestion is the reaction against dogmatic views of the majority of conditioning investigators who claim the universal applicability of their method to all behavioral manifestations in animals. The bold and sincere disagreement of Beritov and his pupils with this dogma of the majority of physiologists signifies that we are at the beginning of great discoveries, when the physiology of higher nervous activity and biopsychology will find ways to reach real understanding of *instincts*. Actually, the hypotheses about humoral chain reflexes as the mechanism of instincts go contrary to reality, since very often we can see a series of instinctive acts that are not connected with one another by action sequence and have no common basis in endocrine activity (the complex building instincts of insects, spiders and other animals).

The most recent attempt to explain instincts by a physiological hypothesis of autoanalyzing activity was made by N. Nikitina (*Archives of Biological Sciences*, v. 33, "On a physiological approach to the interpretation of the nature of instinct.") Nikitina's attempt is really as far from being a true biological investigation of instincts as all previous efforts by physiologists. But her work is interesting, apart from its special conclusions, in that the old physiological conception of instinct as a chain of unconditioned reflexes no longer satisfies even the physiologists. Unfortunately, up to these days some physiologists continue to ignore the psychological essence of instinct because of their physiological interpretation of it.

Lashley's considerations on the inconsistency of physiological efforts to explain instincts by means of the reflex doctrine are of extreme interest. He writes, in his "Brain Mechanisms and Intelligence":

Under the influence of the reflex theory I attempted, some years ago, an analysis of the instinctive recognition of their young by birds (Lashley, 1915) in the hope of being able to determine the particular receptor cells and reflex arcs whose excitation aroused the responses. It was speedily clear that the adequate stimulus could not be expressed in any such terms but was a pattern which might vary widely in detail and in the end-organs stimulated. Similar studies of the sex behavior of the rat (Stone, 1922, 1923) and unpublished work on recognition of the young in the rat and the nursing reactions of kittens indicate clearly that the essential element of the stimulus is not the excitation of a pattern of specific sensory endings but the excitation of many endings in a particular spacial or temporal pattern. A review of the literature

on instinct seems to me to suggest that the characteristic of instinctive behavior as distinct from reflexes is just this capacity to be aroused by a pattern of excitation, irrespective of the particular afferent cells which conduct the stimulus. (p. 158).

And again:

The theory of the reflex was evolved to account for the most unintelligent of behavior, the activities of the "spinal" animal. It was first elaborated in the doctrine of chain reflexes (Spencer) as an explanation of instinct, at a time when no single instinct had been subjected to really critical analysis. More recently and still more critically it has been promulgated by the Russian objective school as an adequate basis for explanation of all behavior. The theory has the advantage of simplicity which makes for its popularity as a slogan; but when one is confronted with the necessity of accounting for a particular group of activities, above the level of the spinal reflexes, in terms of the reflex theory and of working out that account in detail, the inadequacy of the theory becomes evident." (p. 163).

As is clear from this statement, the opinion of this prominent scientist is in deep disagreement with that of many physiologists and confirms our view that the physiological method, although indispensable for the understanding of the mechanism of individual nervous activity, is unable to resolve the problems of the behavioral and psychological evolution of species. At the same time, the physiologists claim that instincts differ from reflexes only quantitatively, but not qualitatively (that is, in the degree of complexity of the chains of unconditioned reflexes) as is stated by biopsychology. This completely contradicts observational and natural experimental data (Wagner).

We claim that instincts, animal intellect and human purposeful activity can by no means be regarded as quantitative complications of chains of reflexes. One must not ignore the psychological specificity of these phenomena, or, still worse, deny them categorically, as certain physiologists do. We must understand that the biopsychological historical method can on no account be replaced by the method of physiological investigation, any more than the latter can be replaced by the biochemical method. Of course, I do not mean that an impenetrable wall exists between biochemistry and physiology or between physiology and biopsychology. I am not going to appeal to the scientists in these disciplines to further academic separation and isolation. Quite the contrary, I believe that genuine dialectical monism of all the natural sciences is not only possible but even inevitable. I say only that this true synthesis will happen not by way of immature generalizations and reduction of complex phenomena to basic, frequently oversimplified elements, but by way of wide-ranging mutual association and in the course of investigations performed by each

scientist in his respective field of science on the basis of the general historical method.

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V. A. WAGNER (1849–1934) FROM THE OTHER SHORE

(My autobiography)

FRAGMENT I

I love music. Many pieces by Chopin, Grieg, Rachmaninoff, and Scriabin evoked colorful images in me and I tried to put them in words.

This is the way I understood music.

Life has come to an end.

Wind is sweeping about the steppe of Freedom.

What has life been granted us for?

These utterances express my attitude to life in general. What is the good of writing an autobiography with such an attitude! If all is transient, insignificant and petty, what can an autobiography give to people and the author himself?

Autobiographies are written for various reasons; some people write for their close friends and relatives; others write because a true story of one's life cannot fail to be interesting if it is written frankly; still others do it to help other people by describing errors and delusions of their own lives, etc.

I am not writing for close friends or relatives, nor am I writing for other people. I am doing this because, despite my contempt of inherited instincts, I enjoy performing actions based on these instincts. In this particular case the instinct in question is the herd instinct—a feeling that I consider stupid and degrading for a person. But that does not matter, let it be low and degrading, but I still have it and like a herd animal am comfortably at ease in my herd. In the same way I follow my herd instinct, join my herd and tell some things from my biography. This is the first reason.

Second, man, like any other animal, after several years of repeated actions, continues doing them under his own momentum even if he considers them trivial. All my life I have been writing down my thoughts on

events in the life of men and animals. Now that I have grown old, I find it easiest to go on doing the same, describing the events of my own life. I enjoy it, since I feel as though I am doing what I have always been doing, though I realize that it is not actually the same thing. When I was dealing with the life of men and animals I described them the way I saw them and understood them, that is, *truthfully* and *completely*. Now I am writing a book for people. While the contents of this book should be my instinctive life, I am not writing of that, as that sort of life has never been described truthfully and completely by anybody, because it cannot be described at all.

Third, I am writing my biography not only because it will be pleasant to organize the bits of my impressions, but also because the recollection of some of them inspire other recollections, sometimes very distant from the starting point. Thus, the picture of my life will become visible in front of me and other people will also be able to see it.

And fourth, I am writing this biography because people, who for more than eighty years have been passing before my eyes one after another, were giving me additional material for the very science the pursuit of which has been for me an inexhaustible source of pleasure for half a century.

So, I am setting out along the road that I have come along once, and such as I am seeing it now, "from the other shore," where impulsive gusts and passions have calmed down, where all is tranquil, and where the daily life of people disturbs me no more but brings about gentle and forgiving meditations aimed at getting at the truth.

FRAGMENT II

. . . if only one could cogitate without contradictions, like Hindu wizards did who lived the life of solitude.

Feelings and emotions are as strong in the old as in young people, but these feelings and emotions are doomed by the laws of evolution based on comparative psychology; they will die, and only reason will be left to mankind. From the point of view of modern tastes it is equal to death as there will no longer be the colors of life, the arts, aesthetics or beauty. . . . Is this not worse than death!

Ask a child if there is any other source of happiness besides toys and a better time than playing and he will reply that certainly there are none . . . as he does not know and cannot perceive any other sources of life. Ask a young man if there can be anything greater than love of woman and he is sure to tell you that there isn't. Ask an old man who has already passed through feelings and emotions of the younger years whether there is happiness other than feelings and emotions. And he will say (if he has used stomach and reproductive organ) that the feelings and emotions that are considered in youth as the summit of ecstasy are in reality evil,

animal instincts and that life is pure without them, that it has already become splendid, and that to feel the splendor of life as it is, one has to be lonely. (See my article on pessimism).

At seventeen, when I was a schoolboy in Tula, I read for the first time the long-awaited publication of Herzen's book "From the Other Shore." The present generation is unlikely to understand what we have lived through and what feelings we had in the early 1860's when, on the one hand, the recollections of serfdom were quite vivid and, on the other hand, everybody around was agitated, some in perplexity and some in secret indignation. . . .

FRAGMENT III

. . . he cannot imagine "what will be when he is no longer extant," or more likely he cannot imagine this because not only man is mortal but also mankind and the whole of our solar system is, because the great luminary will extinguish and darkness and death will come to all the world. . . .

Can it be that we shall see something different when we look from the other shore that I had in mind, or more exactly, that I had in mind when I was writing these lines, as at the time they reach the reader (if at all) the question "What will be when I do not exist?" will no longer be a question for me but a fact. . . .

The question "What will be when I no longer exist?" troubled Leo Tolstoi because he did not ask himself another question, "What was when I was not extant?" To be more precise, he did ask those questions but he did it naively, meaning that "what was" is history, that is, the past days, and that "what will be" is also history. From this point of view his anxiety is quite understandable. But if you enlarge the scale to astronomic figures there will be no room for anxiety.

2. *Pessimism and Science*

Where does pessimism come from? From nature.

Proof I: Nature is a source of definite forms of life and definite disasters. It gives fruit (in water, on earth, in the air). It also breeds snakes, beasts of prey and poisonous insects.

Proof of the 2nd degree: There occur (and become more frequent) thunderstorms, illnesses, avalanches, and floods. Nothing is done by itself, so who is performing evil? Who makes it so that one day the hunt is successful and another day it is a failure? It is clear that there exist good and evil spirits; the former take care of man while the latter do not. This is the way fetishism came to life. It grew, enlarged, penetrated the whole life and occupied the whole world with its concepts. These spirits lived in mountains, deserts, waters, forests, deep under the earth and

high in the heavens. Sounds of life were heard everywhere and people could hear them, feel their attraction, etc.

Time went on. . . . Life evoked a critical attitude in people. They soon began to realise the absurdity of fetishist beliefs. . . . Forests and waters grew silent. . . . Metaphysics (since it was nothing else but metaphysics) destroyed belief in fetishes (excluding faith in God; it is not strong enough to do it. . . . Holbach on God) Nature turned out empty. . . . Turgenev . . .

Man with his infinite complex of factors turned out to be king of nature. . . . In his words he began to oppose himself to nature. . . . It resulted certainly in nonsense, for nature has annihilated him like a grain of sand without his even having noticed it.

Fear of death: Tolstoi, Turgenev, Goncourt.

But intellect prevailed: man stopped chatting and . . .

Forests have come to life, stones began to talk, the air became inhabited. Man began to see what cannot be seen, but it was not spirits, it was reality. Man has found his place in nature, he has become clever, he has understood that in order to live without suffering he must learn and work.

Darwin was not afraid of death. . . .

And a thousand years later man will not be afraid of it, as he will become its master.

FRAGMENT IV

. . . aspirations, though in old age different in their essence than in youth, are still alive in great people, aspirations that are also great and complex. Man was created by cosmic law, but the life he received pulled him away from the cosmic forces in the opposite direction. Laws of spiritual evolution deviate from the laws of Cosmos: Socrates and Christ taught people not to be animals; they stopped being animals but became worse than animals. Syphilis, alcohol, child slaughter and war. When this disgracefulness comes to an end (if at all) life will lose its colors and beauty. . . . Something that urges people to move along the line A-B will disappear and they will follow the line M-N. They will take this course because they will understand that the line A-B which has seemed so full of values (a, b, c), is merely worthless compared to M-N.

Man like any animal is the same creative act of nature as a planet, a solar system, as all except matter and force themselves: they existed pre-eternally.

Succession and Continuity of Evolution

These are words that people juggle with in any way possible, using them first in one sense then in quite another, or using one instead of the other. It is especially characteristic of historians and men of letters.

Suppose a historian discovered in cadastres or other archival rags a description of an incident at the time of a Grand Duke. Given this chance, he begins looking for its cause, begins describing it in terms of succession of historical events, and stating the laws of cultural evolution. In a year's time, another historian discovers in another archive a description of the same incident written down by another idle man. This historian also begins making similar descriptions and deductions, which lead, though, to conclusions quite opposite to those of the first researcher and show cultural evolution absolutely different in direction and orientation. One states that history repeats itself word for word, the other insists that it never does; the first says that events can be foretold, the other assures that there is no telling what the next day will be. History was written before Herodotus, it is still being written now and it will be written for a long time in the future, for there always will be fools who are interested in the private affairs of the English Queen Elizabeth and French King Louis more than in modern life and events of great importance that are happening before their eyes. One can easily understand this, the first is given in a prepared form; there is no need for the reader to use his brains, there is nothing to take any pains for. When already an old woman, Elizabeth tried to look younger than her age, danced a lot to prove something to somebody. All this is already "cooked"; one need only read it and enjoy, while present day events require attentiveness, power of observation and reflection, and good knowledge. Where can every poor mortal take all this from? Present day events are dealt with by chroniclers for 20 cents a line, by reporters for 10 cents a line, and idle people, who, having nothing to do, write diaries, notes, memoranda, memoirs, etc. It is from these memoirs that historians draw information for their writings. No wonder that these writings are dreadful!

Today's lawmaker of a fashionable historical world outlook will be declared tomorrow only a valuable source for some world outlook, because the ideas of the recent lawmaker themselves will be pronounced out-of-date, old fashioned and devoid of any relevance.

Men of letters present the same, if not a worse, picture. Like historians, they discover sources for the modern trends in literature, establish continuity of form and thought, and even speak about laws of evolution. All this is done in accordance with the same pattern as in history.

I knew rather well a man of letters who began his career in the back sections of a literary monthly, where he published his literary reviews and "biting" criticism of books which nobody read, written by authors whom nobody paid any attention to. Desperate to climb out of his stall, he made up his mind to join the acolytes at the temple of Pushkin erected by fetishists and the same "sages" as himself. *Cela pose*. He fed his male and female disciples with Pushkiniana. Everything pertaining to Pushkin was announced sacred, buttons from his waistcoat, a bell he never used, portraits of his relatives to the tenth generation. All that trash was

collected and installed in the shrine where the man of letters lived and served, fighting for order like a retired soldier in a big cathedral who supervises the congregation and walks about with a charity-box collecting philanthropic dole. After that, following Tarde's advice for those who wish to make a literary career, i.e., having committed some meanness, he occupied a position of importance and became a member, and then a leader of a literary society. He began issuing luxurious editions of famous authors, diligently attaching to these editions his own considerations, opinions, thoughts sometimes involving his "friends" in this crime of discrediting the famous writers. This man of letters, one among the many of the glorious pack, first discovered the literary source of the work, which is, as a rule Pushkin, and then made a succession of statements. See how it was done. Pushkin has a line, "I was riding. The night was black; the stars were glistening dimly." Petrov has absolutely the same, "I was riding. The night was black as soot. The stars were glistening dimly."

FRAGMENT V

... remember that "one cannot embrace the unembraceable." But history and literature fade just as do the events that can be neither instrumentally perceived nor explained or understood. History is the plot for sociology; sociology as a science is a rather indefinite superstructure of biology; biology is quite a stable superstructure over chemistry and physics, and our chemistry and physics turn out incomplete and odd, with faults to be corrected, with evident deficiencies, with empty pages still to be filled and with question marks instead of whole chapters on cosmic physics and chemistry.

Messrs historians and literary critics know nothing of that and wish to know nothing of it. Their logic is that of a school teacher of botany: if you plant a seed in the soil, it will sprout and give a stalk and leaves. Then flowers will appear on the stalk and turn into fruit which contains seeds. When the seeds get into the soil, they sprout and so on. And this nice teacher who firmly believes in the indisputability of the science that he teaches to children and young people, thinks that everything in the world follows this law—plant a seed, and you get fruit. And this law was formed in times immemorial. Other more educated teachers speak in this connection of biogenesis, archeogenesis, heterogenesis, etc., but the essence of their ideas remains the same.

Laws of life are to be found in a different place, and when we come to know them we shall see that they are not structured from today backwards and not from the so-called complex to the so-called simple, but from the simple, which in its own way appears to be extremely complex, though not in our present-day understanding of events but in a different sphere of explanation. The events we are investigating are sidetrack

events, they lie "near the road" but not "on the road," near the way and not on the way; life is picturesque—groves, trees, poor villages, luxurious modern palaces, remnants of ancient fortresses and ancient culture, monuments to happenings of many thousand years ago that lie in the waters of the Ganges. All this, both the modern and the ancient, lies in the waters of the Ganges, flowing from the eternal glaciers of the greatest mountains to the eternal glaciers of the ocean.

It is this way—from eternal to eternal—that leads to cognition of truth, and a glance at the world of men from the point of view of this flow will show that the value of the human world equals zero and that there are other values incomparably greater that can be reached only through pure science. Acquisition of these values will lead to the cognition of more precious values that may be described by the saying, "see Lisbon and die!" and that pushes one out to such a platitude that is foolish and incongruous, though still typical of modern humanity.

Life is a dream (see notes from Goethe's "Werter." *Shkola i zhizn* [School and Life], No. 2, pp. 63–64). It is important since the ideas are extremely profound: people do not know the road they are taking and, like children, are fed either with a cake or with a whip (see also: *ibid.* p. 77).

What is a biography in general and autobiography in particular? It is a selection of features of the classification of psychological types that is at the disposal of the writer of biography. An official sorts the facts from the Order of Stanislas of the last degree to the Order of the first degree, coordinating these awards with other facts of his life; a scientist structures his biography from the first printed work to the last; a musician—from the first score to the last, etc. Attached to those stages are dates of marriage, successes and failures, and so on. Who needs it and for what purpose? To my mind nobody does. Only first-rate specialists in tombstones believe that this person was born at this date and died at that date; others are reminded of that by calendars, but most people do not need all that at all. If you take me, for example, I enjoy reading Tolstoy, as well as simply looking through his books, listening to Chopin's music, looking at pictures by Vladimir Makovsky without taking any interest in the dates of their birth and in circumstances of their private life. You may argue that the very life of an outstanding person may be of interest as it is. No doubt it is, with the only condition, though, that it is written truthfully, because in this case only can it be of use with respect to its influence on the evolution of culture, on the development of a personality; and this can and must be written. But what will become then of Pushkin, Lermontov, Turgenev, Goncharov if there are such rascals like Galtsov and B . . . and *tutti quanti*? True, Belinsky, Dobroliubov, and Chernyshevsky interfere then.

To solve this problem, a biography, as I see it, should not be a selection and arrangement of features according to the traditional scheme of classifying personality, but it should be arranged according to the process of interrelation of inherited biological features of a person with his inherited social features, i.e., characteristics of the environment the person lived in and the features he acquired from it. It is clear that such a biography can be construed only by a man possessing adequate knowledge since it is necessary to define (a) biological features of the type (character, temper, will); (b) factors of social inheritance, social psychology and the psychology of the neural life of the subject (his environmental acquisitions); and (c) interrelation of these parameters of the personality in crucial moments of his life (Tolstoy, Turgenev, Goncharov, Chekhov, Garshin.)

CHAPTER . . .

Sparrows began chirping like they do in spring, turbid streams of spring waters were running along the streets, the air became fraught with warmth and sunshine. And with every new day I grew more and more anxious to know what was going to happen in this last spring of my school life. Whether I would get the graduation certificate or fail at the exams. In two subjects I was very weak, Latin and mathematics. But other subjects, too, required much work. Finally, the busy time of the exams came, their schedule was carefully written down in a special notebook; we had two or three days before each examination to read up for it. I went to bed when it was already dark and got up with sun-rise, ran to a vacant classroom, sat down on the window sill and began cramming.

During the last years at school I dreamed of the University, of professors, of student life—the dream. The new generation has not the slightest idea of that dream because the youth now treats the university as nothing more than the doorway to a chamber where diplomas are issued as a guarantee of a job with a more or less fixed salary. For us, students of the 1860's, the University was a temple of science, where one acquired not only higher knowledge but also the rules of behavior, the traditions of older generations of students, which attracted the young people like a magnet attracts metal filings. . . . Will I be admitted there or . . . I did not even want to think of what this “or” might denote.

The Last School Day

The teacher of the Russian language and literature, Gavrilov, who was always very strict about rules and punctiliously came to classes in a uniform dresscoat, came this time in his civilian clothes and addressed us like a “good friend” “I’ve come not to give a lesson but to say good-

bye to you," he said in explaining his attire. You should have seen what effect it had upon the whole class of pupils!

Many years have passed since that time but I still vividly remember this last lesson.

The first exam was in theology; it began with the arrival of the bishop accompanied by the hustle and bustle of theology teachers. Then followed the singing of the prayers "before studies," then smooth answers to the questions of the examination card, rare questions of the white-bearded man with decorations, whose didactic address completed the ceremony opening the examination session. I shall not speak about all the tests; they have been described many times and quite precisely. I shall dwell a bit on those subjects of which I was extremely afraid.

Influenced by Pisarev's articles I had not learned Latin well, and I was sure at the time that Z. B-kov, the teacher of Latin was looking forward to the moment when he would "fail" me. It turned out quite different for me, though, and quite unexpected: he made all possible effort to help me. But his assistant, the teacher of Greek, a man extraordinarily ugly in appearance, who substituted 'r' for 'l' and 'l' for 'r' in his speech (his usual address to pupils was "rittre logues"), who considered pupils enemies to be crushed, found fault with each word, which was not difficult at all and he fully succeeded in it. "You may go." I was told at last. I left, aware of failure. But, as I learned later from our supervisor, it turned another way. After I left, the examiner and his assistant plunged into a hot dispute; the former gave me "a three," while the latter gave me "a two." As the mark of the examiner had more weight, it resulted in "a three"—a satisfactory mark. Therefore the assistant declared that he would give me "a one," to which the examiner declared that he would give me "a four."¹

Crazy with joy after the exam I was rushing about the school building, the yard, and the garden and calmed down only by night. I still had another barricade in front of me which I had to mount before I could think of getting the graduation certificate. This barricade was mathematics.

My close friend, Ki-ev, who was considered expert in mathematics, helped me prepare for the exam. Once, when we were solving arithmetic problems we came upon (or more exactly "he" came upon a problem that did not "come out." He turned it over twice, three times, still it did not "come out." Other pupils also could not solve it. What was to be done? We decided to go to our teacher of mathematics and ask for instructions. We did so. To our surprise we were admitted. We had to wait, though, till the teacher appeared. Having learned what our difficulty

¹ The mark "3" corresponds to the USA "C," "2" to "D," "1" to "F," "4" to "B" (editor's note).

was, he took the problem, read it through and stated that it was quite simple and that he was surprised that we could not deal with such trifles. He began writing on the sheet of paper that we had brought, together with a pencil, for the purpose. He was writing quickly and distinctly but to his great surprise the problem did not "come out." He began anew and again failed. Evidently puzzled and uneasy, he explained that he had been unwell since evening and that the next day he would give us all the necessary information.

But it happened so that the next day he was a bit late and had no time to tell us anything. The exam began. The chief examiner was our principal. He presided with dignity and ceremonially performed all the formalities. He called my name. I came to the table and took an examination card. Without glancing at the card the principal spoke to me, "Well, prove to us that the sum of the squared arms of a right-angle triangle equals the square of "the hypothesis." Evidently, he thought that the word "hypothesis" was the short form for "hypotenuse."² I was not at all astonished, as I had already had more than one opportunity to see the poverty of his knowledge. I proved "the square of the hypothesis" and passed on mathematics. When I took the card I found on it the very problem we could not solve the day before which the examiner himself could not solve.

Flippantly, I took the chalk and began writing on the blackboard, thinking all the time of what would happen when it became evident that the way of finding the solution was wrong. But the amount I came to the crucial point I heard the voice of the examiner. "That will do, the rest is evident. Now tell us what is a quadratic equation. All right. You may go."

No more problems. I was a student. The other exams did not interest me any longer. The solemn figure of the "hypothesis," who came to the exam with a sealed envelope from the Higher Educational Office containing topics for the essays in Russian; the cribs and ingenious methods we used to fool the teachers; curious answers on the history of literature; funny stories about Germans and Frenchmen—all this passed before my eyes, touching me no more than the conflicts in the class. All those conflicts and clashes brought about no troubles as we had a firm conviction that no one would be left back and everybody would get a certificate. From that moment, preparations for "going home" began. I was not "going home" but to private lessons, to the Venev district to teach two boys. This did not distress me at all. On the contrary, I had a pleasant anticipation of evenings and good living conditions. And above all, I would have an opportunity to discuss university life, as I was told that a second-year student of Moscow University had been invited to the

² In Russian the word 'hypothesis' is shorter than "hypotenuse."

family of the landowner's daughter to teach her son. All this gave a new tonality to my life and tuned my thoughts in a new way.

FRAGMENT VI

I am seventy-five today (1924). It is a splendid age and a splendid day, especially because you have honored me with your greetings and good wishes. Yet, it is because I am seventy-five that I cannot see in these greetings, wishes, and especially in the appraisals of my work what I might have seen if I were forty or fifty.

Until a certain, sometimes rather considerable age, people are thought to be inclined to self-admiration, or, at least, are of a higher opinion of themselves than they have the right to be. All sorts of jubilees with their exaggerated praises are poison, and the more dangerous the more inclined a person is to self-admiration. One must be quite stupid though, not to come with age to a realization of the modest capacity of one's powers, and the insignificance of what has been done. The natural sequence of this state of things is disappointment, which is all the more painful the stronger the self-admiration has been. A happy person is the one who has never admired himself; festive speeches will not do him any harm, particularly when he has to listen to them at seventy-five. At this age, it is not feelings but reason that governs a person's behavior. The analysis of the jubilee speeches is gold dust that is worth working with even if it is only but one hundredth pure gold.

What do I mean by pure gold? What is the value of these gold washings? First, respect for unselfish scientific activity has always been in first place, and has been characteristic of the faculty that so clearly expresses itself nowadays. A country where this feeling is alive has the best and most reliable promise of its happy future. Secondly, I see the value of the above mentioned gold in the following: the cause I serve in this technical school is easily consolidated and has acquired features typical of the amalgamation of the solidarity of the teachers and the realization that the path they have taken is right. Third and last, the value of the gold washings consists in the fact that I felt for the first time today that friction between the older and younger members of our school family is nothing but the usual unavoidable contradictions between fathers and sons who are trying earnestly and honestly to establish their relations. These conflicts are not intended to undermine the common cause, otherwise the possibility of work at the school would be threatened. But as it is, the relationship becomes natural, teachers and students are linked by mutual trust and the understanding that they have goals and objectives in common, which will inevitably lead to normal cooperation and assistance. This understanding will bring about the situation in which the belief of young people in their abilities and of older people in the value of their knowledge will be balanced so that work will be a source of

pleasure because its usefulness will be evident. This is the pure gold extracted by the analysis of my mind today and this is what I am cordially thankful to you for.

Gold dust is that part of the jubilee speeches that expresses ideas and wishes of a definite social group, its indication of what is expected from the hero of the day, what requirements he should satisfy. In this sense the auriferous ore is a genuine social phenomenon.

The extracted gold is that part of truth, which the person who is honored can apply to himself without being afraid of a mistake. I shall say nothing of auriferous ore; it has presented itself in the brilliant speeches of my friends just now. I shall say a few words about what is the pure gold in them.

There is an old picture showing a man's life at its various stages, from babyhood to old age. He goes part of his way uphill, walking cheerfully with his head up; the other part is downhill and he walks it with drooping head, bent figure, with an air of helplessness and suffering. I am seventy-five and my figure and my health should remind us of the old man in the picture of a man's life, giving the idea of helplessness and suffering. I do not feel either, though. I am more than ever interested in the progress of science, I more than ever believe in its wondrous powers.

Today much as been told about my talents and mental abilities and other virtues which make me outstanding among my "average" colleagues. I emphatically object to it. If I have preserved my scientific curiosity, if I have not bent my head under the burden of years but keep it up just as cheerfully and look to the future with hope, it is not at all because I was more endowed than others, but it is only because I have made use of what has been given to me by nature in the way I did it. And even the choice I have made, the preference of scientific interest to all others, as well as the choice of educational activities as a professor, is nothing exceptional or unusual. If it were not so, neither would have met such unanimous approval as has been expressed today so beautifully and touchingly. And if it is so, then why, judging by my good health and by what has been said today, am I not going downhill but uphill; why, gifted by nature in the same way as other people, have I stepped aside so demonstratively from the picture of life distorted by nature?

I think it is so only because I have chosen the way upon which nature still dictates its laws but not so categorically. Cognition of its laws is a key to becoming its master instead of its slave. It is a far way off, but the future is already dawning on the horizon showing mankind what road to take.

Looking back at my lifetime journey where, like any other man, I had fewer sunny days than cloudy periods, I can say that I took little notice of the weather and went on with my work and enjoyed it, finding in it the source and sense of life, never stopping and wishing to have a rest. Finally, it turned out as it should have turned out, for nothing human

is alien to a human being, and everybody finally came to the opinion that their lawful work should be aimed at the cognition of truth and that its application should be for the benefit of society. Many thousands of people have passed before my eyes, and thousands of times I had an opportunity to see that they sympathized with what I was doing, though without the slightest interest in the essence of it; their empathy was kindled by the sincerity of my belief in knowledge and by the firmness of my conviction of the correctness of the chosen path.

There is one more thing that I have come to understand after years of my life and that I distinctly see now. When it happened that I had conflicts with other people in the sphere of scientific work or in the sphere of practical teaching activity, I always tried to define the degree of my own guilt in the conflict. And as a rule—the exceptions were very rare—I came to the conclusion that action was always equal to counteraction and that my guilt was no less than that of my opponent.

This is how I have lived; and now, when I am approaching the age about which Leo Tolstoy wrote that after eighty he considered every new day as an undeserved gift of fortune, I am not going to thank fortune for its gifts.

I have much more belief and interest in the progress and achievements of science than in the benevolence or adverseness of this ghost of the old culture. What I have seen in life brings me to a conviction that mental work, if it is serious and sincere, rejuvenates a person, gives him not only spiritual but also physical vitality and strength.

FRAGMENT VII

1. The book is the only world where man can find immortality.
2. The world is a book, which, when properly understood, will lead man to giving up immortality even if it were possible.
3. Life is a book whose contents is known only to its compiler, and whose value for the author is higher than the value of all the libraries of the world.
4. The book of life written to the end goes to the grave together with its author; for other people's use he has been writing, during all his life, another book judging by which the readers are trying to guess the contents of the former—an occupation that is dull and unproductive.
5. If there were forces that could reanimate the dead person and he were offered to write the book of his life anew, the offer might be taken only by a fool.

FROM THE HISTORY OF COMPARATIVE PSYCHOLOGY IN THE USSR

D.B. Malakhovskaya (Khotina)

Boris Iosifovich Khotin (1895–1950) was one of the first Soviet investigators in the field of comparative psychology. His scientific work began in the middle twenties at the Department of Comparative Psychology of the Herzen Pedagogical Institute in Leningrad and at the Institute for Brain Research in Leningrad headed by V. M. Bekhterev.

Khotin was a pupil and the closest assistant of Professor V. A. Wagner, an evolutionary psychologist, the founder of the Soviet school of comparative psychology. Wagner raised the study of animal behavior to the level of an independent scientific discipline in Russia. Khotin's scientific interests were formed under the influence of the revolutionary ideas of his teacher (Strelchenko, 1975).

Khotin's major work was devoted to the study of imitation in animals. This aspect of his scientific activity has been elucidated in detail in the comparative psychological literature of recent years (Strelchenko, 1975; Malakhovskaya, 1971, 1975; Fabri, 1974, 1976). He was interested in instinctive (inborn) behavior, which in its simplest form is manifested in one individual following another: a child following its mother, a member of a herd following the leader or another member, and so forth (Khotin, 1930a,b,c).

Having adopted Wagner's evolutionary approach to the working out of psychological problems, Khotin turned to the study of imitation in the phylogenesis and ontogenesis of vertebrates. Hence the amazing diversity of the species he used for his experiments: fish (wild carp), birds (doves, hens), and mammals (rats, cats, dogs, wolves, sheep, reindeer, monkeys), studying young animals as well as adults (Khotin, 1930a,b,c, 1946; Roginski & Khotin, 1930, 1934; Viziarykin & Khotin, 1946a,b; Blagoveshchenskaya & Khotin, 1930; Khotin, 1947a; Aronovich & Khotin, 1929; Aronowitsch & Chotin, 1929). Such a wide range of investigation

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deserves profound respect, especially in view of the fact that the experiments were carried out more than half a century ago, when research in science and technology was less sophisticated than at present, and the rat was almost the only experimental animal used in comparative psychology all over the world (Scott, 1973; Adler, Adler & Tobach, 1973).

Khotin was interested not only in imitation, but also in the interaction between this inborn form of behavior and an acquired form of behavior, namely learning. He developed the method of "experimental conflict" in which responses based on imitation were placed in opposition to those that had been learned. For example, two animals were put into a situation in which the positive signal for one individual served as a negative signal for the other and vice versa. The two animals had been conditioned separately. For one animal, for example, a red light was a signal to run and a blue light a signal not to run. The opposite was true for the other animal. Then, after the conditioned reflexes had been firmly established, the two animals were placed together. If one animal followed the other animal irrespective of the given signal, despite its individual experience, one could conclude that in this case imitation predominated over learning. If, on the contrary, each of the animals behaved in accordance with its individual learning acquired in isolation, it was clear that learning prevailed over imitation. This method, in combination with other methods, made it possible to understand the nature of the relationship between imitation and learning in different animals, as well as to make a picture of the development of imitation in ontogenesis and, in part, in phylogenesis.

Aiming at conducting his experiments in a situation similar to the animal's natural environment, Khotin designed a special maze that can be restructured, which allowed a quick change of the experimental conditions, and could, to a degree, model the situation for natural behavior (searching for food, for a sexual partner, for ways to escape, and so forth). Besides the maze, various other devices were used in the experiments: the behavior of carp was investigated in a specially equipped aquarium; sheep and reindeer were observed in a special enclosure; monkeys in a cage of unique construction; dogs in an experimental corridor, and so forth.

On the basis of his investigations Khotin drew a number of general conclusions concerning imitation and learning in vertebrates. After comparing his data for fish, birds, and mammals, he proposed that in the process of phylogenesis imitation describes an inverted "U" curve: on a phyletic continuum, as complexity increases, imitation at first is stronger and then becomes weaker. This is also true in ontogenesis: Imitation first appears at a certain age, gradually increases and eventually, as the individual acquires its own experience, imitation attenuates and disappears altogether.

These concepts apply to altricial animals. In the case of precocial

mammals and birds, the young begin to follow the mother as soon as they come into the world, imitating precisely all her actions. In these young, too, imitation fades away with age and is replaced by individually acquired behavior. All this shows that imitation is a maturing function depending on the stage of development of the central nervous system. In the experiments with puppies it was especially clearly shown that imitation is a factor favoring the elaboration of individual skills in the young, and that it can serve as a foundation for learning. "Without exaggeration, one can say," wrote Khotin, "that all the benefits that accrue to the young by 'tradition,' enabling the offspring to learn from the life experience of their parents, could not be realized if it were not for imitation of the adults by the young."

The data gathered by Khotin proved that increased complexity of the structure of the brain is accompanied by an increase in the plasticity of individual learning and that the peculiarities of the learning process in different species correspond to the life conditions of each of the species (Khotin, 1946, 1947c). In the wolf experiments, for example, the learning process consisted in a number of initiative actions, such as shortening the path in the maze by running diagonally, or suddenly correcting an erroneous path and finding the proper alley. Learning relates to individual behavior and is an important factor in the adaptation of animals. The similarity of the phylogenetic and ontogenetic imitation curves suggested to Khotin the existence of a biogenetic parallelism in the development of imitation (Khotin, 1947b).

Khotin's investigations led him to the conclusion that imitation is a powerful bonding factor in the social and family life of animals leading to biologically valuable consequences. Based upon instincts, imitation at the same time often serves as a basis for the development of individually acquired behavior, or learning. Thus, as far back as the late twenties, investigation of the problem of imitation and learning was conceived and carried out, in its greater part along broad evolutionary lines, with extensive experimental material.

In order to investigate the behavior of animals in their natural life conditions, Khotin organized several expeditions to the Arctic, where he studied habits and instincts of birds in bird colonies. Especially interesting and fruitful was a complex expedition to the Novaya Zemlya Islands, where there were vast bird colonies near the Bezymyanny Cape. Here he observed the social life of two species of birds: plovers and gulls (Khotin, 1934, 1934-35a,b).

As a result, a number of facts were gathered, proving Wagner's thesis of the inverse relation between the parents' instinct of self-preservation and their instinct for the care of their young. In birds, the instinct for the care of offspring seems to reach its maximum intensity by the time of hatching. During that period the instinct of self-preservation is almost

entirely inhibited: Trying to protect their offspring, the parents seem to be neglecting their own safety. As the nestlings grow, the self-preservation instinct in the parents begins to strengthen again, and now, in case of danger the parents fly away, abandoning the more developed, though still helpless, chicks.

A number of experiments were carried out on the substitution of eggs from under the hatching bird, on the transfer of the eggs from the nest to another place, and so forth. The results of the experiments confirmed the popular opinion that instinct is "blind," that is, the range of its effectiveness is limited.

Other experiments included the substitution of one nestling for another, the temporary blinding of the birds by means of capping, etc. Observations were made of the behavior of plovers at the moment of fledging, as well as of the activity cycle of the bird colonies in the conditions of prolonged Arctic daylight (Blagoveshchenskaya, Zaks, Khailovitch & Khotin, 1933; Roginski & Khotin, 1930; Khotin, 1934-35a,b). Khotin concluded that the colonies of plovers and gulls belong to the category of "chance gatherings," according to Wagner's classification. One of the main reasons for the emergence of colonies is the limitation of territory for nesting. The proximity of the common feeding area and the protection of the nesting sites from strong winds are also of great importance.

In 1934-1935, Khotin wrote a comprehensive theoretical paper entitled "Biological Psychology as a Science" in which he set forth his ideas on the essence of comparative psychology and the significance of its applications. Unfortunately, this work was not published until now (Pp. 10-36). A number of other papers has never been published. Khotin's scientific activity was interrupted in 1935, and he was able to resume it only after the end of World War II, when he was discharged from the army. In 1946, while working at the Bekhterev Institute for Brain Research, he summarized the results of his previous work and set them forth in a monograph, "On the Phylogenesis and Ontogenesis of Imitation and Learning in Vertebrate Animals" (Khotin, 1946).

During the last years of his life Khotin was gathering materials for a monograph, "Truth and Invention about Animals in Fiction." Considering the depictions of the behavior of animals in the works of Russian and foreign writers, he observed that in most cases such depictions suffer from anthropomorphism, and came to the conclusion that the writers describing the life of animals should know the biological foundations of their psychology. This work was not finished.

The works of Khotin were innovative for his time. They are indicative of the high level reached by comparative psychology in the USSR in the middle twenties and early thirties, exactly in that period, which, according to Scott (17), was a period of stagnation for comparative psychology

all over the world. In spite of the fact that many years have passed since these works were written, they not only have historical interest, but to a great degree can be useful for those who work in this field now.

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COMPARATIVE PSYCHOLOGY IN RUSSIA

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The autobiographical fragment by Vladimir Aleksandrovich Wagner (or W. Wagner, as he signed his name for Western publications) harks back to the first *glasnost* of the 1860s, when Wagner was in his teens and Alexander II was opening free discussion and ending serfdom, tilting the Tsarist system toward the revolutionary collapse of 1905–17. That earlier *glasnost* allowed Herzen's *From the Other Shore*, which the exiled radical had published abroad in 1850, to appear in Russia in 1866. Almost seventy years later the aged Wagner, sitting down in Stalin's time to review his life, remembered above all the thrill of reading Herzen's revolutionary essay at the age of seventeen in provincial Tula. Putting Herzen's title at the head of his own lifestory, he was obviously reaching for an emblem, but we can only guess what he meant to suggest . . . perhaps that he was going into internal exile, feeling the same need as Herzen to explain his motives and to guess, as Herzen did, what wild changes the historical process might bring, on the chance that some future generations of Russians might have the freedom to read and the independence to understand.

It is a pity that the manuscript before us is so fragmentary. Let us assume that the aged Wagner accurately recalled the central themes of Herzen's essay. In Western exile he was free to publish his thoughts, but his conscience was bothering him for abandoning the struggle to improve the native land. He did *not* assume that Russia must simply copy the West, where he had observed the wholesale slaughter of Parisian workers when they demanded public work projects to relieve unemployment. In Herzen's essay sailing away from home became a metaphor of swiftly changing history, West and East. The institutions we know fade rapidly into the past, and we do not know what new ones we will find, or be judged for creating, at the other shore, the imagined place of arrival. Herzen's radical self dreamed that Russia would move through socialism

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to freedom, while the West would move through freedom to socialism. His grimly prophetic self foresaw general ruin, but scorned the conservative dream of trying to arrest the historical process: "Better to perish with the revolution than to seek refuge in the almshouse of reaction."

Was all that in Wagner's mind when he sat down at 84, and put Herzen's title at the head of his lifestory? These fragments do not tell us. Such bits and pieces of the tormented past have been tumbling out of public archives and private collections since Gorbachev started the second *glasnost*, which has led so swiftly to collapse of the Soviet system. Perhaps we should speak of the apparent collapse, reminding ourselves that the Soviet system, like its Tsarist progenitor, shaped, and was shaped by, stubbornly persistent habits of thought and behavior in Russia.

Meantime students of Russian psychology—I mean both the historically developing mental habits of Russians and the multifaceted discipline called psychology in their country—must make do with what we have. We are supplied here with documents from Wagner's pen. There is a speech replying to compliments and congratulations at a celebration of his seventy-fifth birthday in 1924. As usual with such effusions of sentiment, it tells us rather little, beyond the fact that those who respected comparative psychology were still sufficiently numerous and self-confident to do public honor to the man who founded that branch of the discipline in Russia. That fact is in sharp contrast to the situation revealed by the document of 1932(?), a memorandum that Wagner wrote to the People's Commissariat of Education pleading for the restoration of his discipline in institutions of higher learning. It had suffered a sharp reversal of fortune in the time of Stalin's "revolution from above," 1928–32. And finally we have the fragments of autobiography, evidently written shortly before his death in 1934.

In the sentimental speech of 1924 there is a passage, toward the end, confessing belated recognition of shared guilt for unspecified conflicts. That deserves some comment, for it seems to echo the story that Chekhov was moved to write after lively discussions with Wagner in the summer of 1890. Wagner interpreted Darwinism to justify the right of the strong to stamp out the weak, so as to check the degeneration of the race, which was an obsessive concern at the turn of the century. Note within his autobiographical fragment the echo of contention between scientists and humanists, and note his continuing worry about degeneration. Chekhov's imagination turned the argument with Wagner into "The Duel," a tale of conflict between a vigorous young zoologist and a humanist layabout. It culminates in a duel that threatens virtual murder, for the zoologist is a practised marksman and the humanist knows nothing of guns. At the last moment a churchman deflects the shot that would have been fatal, and the story ends with the chastened Darwinist and the humanist agreeing, "No one knows what's really right." (Literally: "No one knows genuine *pravda*," the famous Russian word that runs together factual

and moral rightness.) Wagner was proud of his association with Chekhov, and we must wonder if the famous story that he helped to inspire was in his thoughts as he confessed his share in guilt for unspecified conflicts.

He had been all along a wideranging intellectual as well as a specialist in the study of animal behavior. For the "thick journals" that the educated public favored in the nineteenth century he wrote articles on topics such as pessimism and the *Weltanschauung* based on natural science, which also echoes in the present fragments. Nietzschean philosophy was supposed to transform the depressing sense of ourselves as transient objects into triumphant self-expression, pointing toward the transcendent Superman. Wagner published prerevolutionary articles on such themes, which also echo faintly in these fragments. Note the scorn expressed for the new generation of students who are interested only in training for a narrow profession that will ensure them an income. Note the scorn for himself, for submitting to the "herd instinct" though his intellect tells him that it is "stupid and degrading." Here and there one can detect bits of other, inconsistent themes of the nineteenth century, a period of enormous ideological creativity: confidence in human progress as proved "scientifically" by Herbert Spencer, or failure of such confidence and a turn to ataraxia, philosophic indifference, as preached by the ancient Greek and Roman naturalists, who also assumed that we are transient clumps of living atoms, and cultivated a sense of kinship with the void that awaits us, with nothingness.

Yet Wagner did care about public causes, including the discipline of comparative psychology, which he implanted in Russian institutions of higher learning. The article by his disciple Khotin situates Wagner in the two-front struggle that focused his efforts in psychology: against anthropomorphic reading of human mentality into subhuman behavior, and against the reduction of all levels of mentality to the mechanics of nerve systems. That struggle began before the Revolution and continued to the grim moment in the 1930s when comparative psychology was virtually condemned by Stalinist ideological authorities, who declared anathema on pluralism and demanded a monolithic psychology. Pavlov's "teaching" was supposed to be the foundation of the monolith, and Wagner had been an early, sharp critic of Pavlov's simplistic dream that the reflex arc provided an escape from the complexities of evolutionary reality.

Unfortunately, Stalinist constraints on debate obliged Wagner and Khotin to refrain from full, frank analysis of their disagreements with Pavlov and his school. I note in particular Khotin's reluctance to challenge Pavlov himself with explicit criticism of his obvious errors. The most obvious was his insistence that imagined processes in the cerebral cortex are the universal explanation of all learned behavior, though many animals that exhibit such behavior lack a cerebral cortex. That had been pointed out from the first appearance of Pavlov's "teaching" in 1904,

and not only by Wagner. Bekhterev, the major rival to Pavlov for leadership in the neurophysiological approach to psychology, called attention to such flaws. The reader should also be aware that Bekhterev, though ostensibly insisting on "reflexology" as the ultimate basis of psychology, was quite tolerant of many different schools and approaches, as Pavlov was not. Hence Wagner found the first institutional base for comparative psychology within Bekhterev's Institute, which flourished for a while under the Soviet regime, but suffered severed cutbacks in the 1930s, when the ideological establishment turned against Bekhterev's school and started the deification of Pavlov's "doctrine."

Khotin's article was written in 1934–5, while he was at the Bekhterev Institute in Leningrad, just before he was arrested, exiled to Central Asia, and transferred to hospital work as a neurologist. His daughter Malakhovskaia deserves special thanks for furnishing that precise information. He was obviously making a last-ditch defense of comparative psychology within the framework newly established by Stalinist ideological authorities. The article evidently failed to persuade them, even though it gingerly recalled their conflicts with Pavlov and his school in the 1920s. Back then Pavlov had invoked reflexes of freedom and of purpose in his efforts to show that the science of physiology contradicted Marxism, but Khotin was not free to dwell on that conflict, for Pavlov and the Soviet authorities had got over it.

After a 1932 meeting in Gorky's apartment between Stalin and representatives of Pavlov's school, Pavlov moved toward reconciliation with the Soviet system, and finally gave an enthusiastic endorsement of it. Within that context one can understand the timid quality of Khotin's criticism, his tendency to point at a few disciples of Pavlov rather than the master, his clumsy appeal to Marxist dialectics as the main reason to favor the concept of emergent levels of mentality and to reject the reduction of all mentality to reflex arcs. If he had vigorously demonstrated the obvious discordance between Pavlov's school and worldwide trends in neurophysiology, he would have been challenging the recently established rule that Soviet science must be different from "bourgeois" science, that it must be "Marxist" in a unique, confessional sense of the very ambiguous term. If he had vigorously demonstrated the obvious discordance between Pavlov and Marx, between neurological reductionism and an historical and cultural approach to understanding the human animal, Khotin would have been openly challenging the power of the ideological bureaucracy to be, under Stalin, the official interpreters of confessional Marxism. Whether reasoning from science or from ideology, Khotin was damned if he did and damned if he didn't. That he tried at all is a tribute to his courage and his intellectual integrity. That he got as far as he did in his reasoning, in bringing out the scientific and ideological issues which were being frozen by the deification of Pavlov's "teaching," is evidence of keen intelligence.

Perhaps a gloss is needed for Khotin's appeal to the work of Beritov, or I. S. Beritashvili (1885–1974), as this Georgian physiologist began to sign his publications when the Soviet regime fostered the development of national pride among the non-Russian populations of the former Russian Empire. Like Lashley in the United States, Beritashvili moved from admiration of Pavlov's experimental method and line of reasoning to criticism of the imaginary neural circuits that Pavlov invoked to explain his results. Beritashvili was much more outspoken and insistent in his criticism than the comparative psychologists in Russia, perhaps because the Georgian context in which he worked gave him a greater sense of autonomy with respect to the ideological bosses in Moscow. He combined efforts to figure out the real neural circuitry of conditioning with speculation about the nature of mental "representation" (*predstavlenie*, *Vorstellung*), a concept that he insisted was essential to the analysis of learning, even in such lowly animals as chickens or turtles, since they show firm memories of particular places where they once found food. When Khotin ostentatiously criticizes Beritashvili for attributing mental representation to subhuman animals, and invokes Engels to support the criticism, we must wonder what mixture of styles we are witnessing, of authentic scientific disagreement and artificial pleading before the ideological authorities.

Such efforts to disentangle science and ideology within the Soviet context can too easily turn into a form of self-deception among Western scientists, who have no explicitly identified ideological authorities supervising their controversies and may therefore imagine that they have no ideological elements in their scientific reasoning. Khotin's article, if read with the care it deserves, should remind us that the Soviet wrangle over comparative psychology and neural reductionism was a peculiar version of a worldwide contestation that continues to the present. The absence of ideological bosses does not signify the absence of ideological issues. On the contrary, lacking established authorities to lay down a line of demarcation, ideological and scientific issues are mixed up with a fiendish subtlety, challenging neuroscientists and comparative psychologists to be rigorously critical of themselves as well as their adversaries. Careful attention to the history of past mixtures can be a sobering and enlightening approach to such rigor.

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V. A. WAGNER AND THE ORIGIN OF RUSSIAN ETHOLOGY

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The rise and development of Russian ethology provides a unique case for historical study. In the early twentieth century, the original school of naturalistic research on animal behavior developed quickly in Russia. But, at the end of the 1930's, when such investigations were being expanded in Europe, naturalistic studies had come almost entirely to a stop and had little influence on the subsequent elaboration of Russian ethology in the 1960's. Consequently, modern Russian ethology is based on Western programs and traditions in general.

Many Western historians have analyzed various aspects of ethology: its theoretical and methodological propositions (Gray, 1968, 1969; Jaynes, 1969; Richards, 1987); the development of different approaches and methods (Gerardi, 1984; Burkhardt, 1981); the contributions of various scholars (Richards, 1977; Gray, 1967, 1968; Huxley, 1963); the influence of ideology and politics (Kalikow, 1983) and other considerations of the origin and rise of ethology (Thorpe, 1979; Singer, 1981). But Western historians have not mentioned Russian ethological investigation. The history of Russian comparative psychology is found in only a few summarizing annual reviews (Roginsky, 1947; Ladygina-Kots, 1960); and of ethology in the article by Krushinsky (1975); in several biographical notes on Wagner (Dogel', 1934; Roginsky, 1940; Fabri, 1969; Lukin, 1987), and in short abstracts of reports at different conferences (Malakhovskaya, 1975; Strel'chenko, 1975; Blagosklonov, 1978).

Did Russian ethology ever exist? Why did not Soviet ethologists build on the legacy of their forerunners? And why did not Russian ethological research have an effect on Western studies? It is impossible in a short

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paper to give a complete account of the history of Russian ethology. I present only a few episodes that reflect important moments in this history.

WAGNER AND RESEARCH ON ANIMAL BEHAVIOR

In Russia the founder of the naturalistic approach to animal behavior was Vladimir A. Wagner (1849-1934). Wagner was educated in law and then in physics and mathematics at Moscow University. The range of his scientific interests was extremely wide: comparative anatomy, sociology, taxonomy, psychiatry, pedagogy, evolutionary theory and musicology. His first research was in the field of comparative anatomy. Under the influence of A. O. Kovalevsky and I. I. Mechnikov, he studied the blood cells of some marine invertebrates. At the same time, he began to work on the taxonomy of spiders. It was from this taxonomic research that Wagner's interest in studying animal behavior arose and it affected all his later work.

Wagner often indicated that his approach to animal behavior was inspired by Charles Darwin, but he rejected the anthropomorphic interpretations used by Darwin and his followers, e.g., Romanes, J. H. Fabre, and J. Lubbock. This stimulated his search for an objective approach to animal behavior.

Wagner's approach was not a simple transfer of the methods of comparative anatomy to a new subject, comparative psychology. Wagner principally created a new approach to comparative studies. Wagner was the first to study intraspecific variation of behavioral characteristics.

When we have finished the comparison of many webs of the one species and have established its typical characteristics, we move on to the same comparative investigations of another, a third, etc. species of the same genus of spiders. (Wagner, 1896, p. 61)

Then a generic type of web should be compared with typical webs by another genus of the same family. The same principle should be used for the comparison of families, orders, etc. On the basis of the material of such comparative studies Wagner concluded: "the forms originated from the general root remain in relation to one another not only by morphological characters, but by the peculiarities of instincts too" (Ibid, p. 65).

In his thesis for the degree of doctor of zoology (!) entitled "Biological method in zoopsychology," Wagner (1903), substantiated the subject, methods, and aims of the new scientific discipline, which he later named biopsychology (comparative psychology). By his definition, biopsychology is the study of the laws and trends of behavioral evolution. The basic method of biopsychology consists in field observations and experiments on behavior of individuals of the species under natural circumstances.

The data produced by these methods are used for comparative analysis of behavioral features within a taxonomic group and offer the opportunity to discuss the trends and mechanisms of the evolution of these features.

Wagner's concept of behavioral evolution contains two respectively independent parts. The first treated the questions of the evolution of certain forms of behavior, such as nest building, sexual behavior, parental care, feeding behavior, etc. Wagner considered every concrete form a compound hereditary instinct. The evolution of the instinct resulted from the natural selection of occasional variations that created a statistical spectrum of species-specific instinct (Wagner, 1900a,b).

The second part of his concept treated the question of the evolution of types of behavioral reactions. Wagner distinguished three main types of behavior: reflexes, instincts, and behavior of a "reasoning type." Many authors before Wagner tried to constitute a linear evolutionary series, connecting these three types (see review by Lilin, 1911). Wagner proposed that the evolution of the main behavioral types was nonlinear, and occurred independently and in parallel in different branches of the animal kingdom, proto- and deuterostomata. Both instincts and reasoning behavior, according to Wagner, arose from the simplest reflexes and then developed in parallel, so that instincts generally developed in the branch of protostomata, and reasoning behavior in the branch of deuterostomata.

Wagner's ideas and methods of behavioral studies were very popular among Russian zoologists, and his ideas were widely disseminated in Russian scientific literature (Karavaev, 1906; Pogodin, 1905; Zav'jalov, 1913). Among zoologists Wagner was recognized as the authority on behavioral questions.

It should be mentioned that there is a great similarity between Wagner's approach to these problems and those of classical Lorenzian ethology. But the ensuing history of Wagner's ideas differed greatly from that of Western ethology.

BIOPSYCHOLOGY OR PHYSIOLOGY

Early in the 20th century in Russia, in parallel and simultaneously with Wagner's investigations, another approach to behavioral studies, a physiological approach, was developed. The foundation of the physiological study of animal behavior was built by two famous scientists, I. P. Pavlov (1903) and V. M. Bekhterev (1904). There was much discussion between the naturalistic and physiological schools on the content, methods and aims of behavioral studies. Wagner's main opponents were the physiologists of Pavlov's school (Zeleny, 1913a,b; Frolov, 1913). Bekhterev and his pupils generally studied human behavior, but they took part in the discussion also (Bekhterev, 1912). In response to the physiologists' criticism, Wagner published a special volume entitled "Biopsychology" that included two of his papers: "Physiology and biology in the formu-

lation of psychological problems" (Wagner, 1914a) and "Segmentary psychology" (Wagner, 1914b). In these papers, Wagner analyzed in detail the arguments of his opponents and gave new data to support his point of view.

For Wagner, as a naturalist, the main aims were explanations of the purposefulness ("biological sense" in Wagner's words) of concrete behavioral forms, of the differences in the displays of various species and of their evolution in concrete phylogenetic lines. Thus, he tried to describe animal behavior continuously, as a whole, and to study behavior in nature. To describe whole behavioral patterns, which have a "biological sense" (feeding, breeding, self-defense, etc.), Wagner used the notion "instinct," the main characteristics of which, were species-specificity, heritability and adaptability.

Physiologists generally simplified the conditions of their experiments (e.g., "the tower of silence" of I. P. Pavlov) and studied behavioral units; it did not matter what kind of units . . . reflexes, tropisms, stimulus and response, trial and error, etc. They ignored variation in these behavioral units as a "mistake of the experiment." Such an analytic, "elementary" approach led physiologists to the interpretation of "instinct" as a chain of separate elementary actions (reflexes, tropisms, etc.).

The main results of the polemics between supporters of the naturalistic and the physiological approaches were verification and concretization of the subject fields of each school, and the search for a suitable methodology for the study and interpretation of animal behavior. Therefore, supported by the authority of the "number one physiologist," I. P. Pavlov, the tendency for physiological studies to monopolize all behavioral investigations, played a negative role in the next, the Soviet period, of the development of Russian ethology.

ETHOLOGY IN SOVIET RUSSIA

Before 1917, except for a few physiological laboratories, there were no special scientific institutions for the study of animal behavior and its evolution. Special courses on comparative psychology were given only by Wagner in the Moscow and Petrograd Universities and in the Psychoneurological Institute. After the Russian Civil War, institutes were created under the authority of various Narkomats (People's Commissariats, or ministries), generally under Narkompros (Commissariat of Education) and Narkomzdrav (Commissariat of Health). Some of these were:

Zoopsychological Station of the P. F. Lesgeft Natural Science Institute in Borisovka (Arens, 1924)

Zoopsychological Laboratory of the Institute of Experimental Biology (Sadovnikova-Kol'tsova, 1925)

Practical Laboratory for Zoopsychology (Durov, 1924)

Zoopsychological Laboratory in the Darwin Museum (Ladygina-Kots, 1921)

Laboratory of Comparative Psychology of the Institute of Experimental Psychology (Borovsky, 1925)

Department of Biogenesis and Comparative Psychology of the Brain Institute (Aronovich & Khotin 1929)

Special courses were given in different institutes: in the Moscow and Tashkent Universities by D. N. Kashkarov; in the Stavropol' Agricultural and Pedagogical Institutes and in the Petrograd University and Pedagogical Institute by Wagner. Reports concerning problems of animal behavior and its evolution were regularly given at various conferences; for example, at the All-Russia Congresses of Zoologists, Anatomists and Histologists. At the First Reflexological Congress on Human Studies, a special symposium "Comparative Psychology" was organized by Wagner and his pupil, B. I. Khotin. At the symposium eight speakers gave reports.

At that time publishing activity was very high. About ten books devoted to animal behavior were published annually. Translations of the books of leading foreign scientists such as J. Loeb, J. Watson, W. Dilley, and E. Thorndike were published.

At the institutions named above a great variety of research was conducted that can be divided into three groups: study of innate, species-specific behavior in the field (Wagner's tradition); experimental analysis of free behavior by using mazes, problem boxes, multiple choice methods, etc. (the behaviorists' tradition); and the study of behavior by using the method of conditioned reflexes (Pavlov's tradition). Thus, in the first half of the 1920's in Russia, the preconditions existed for the development and continuation of Wagner's traditions in ethology, as well as for the formation of institutional communities based on those traditions.

However, at the end of the 1920's, the variety of investigations united under the general name of "comparative psychology," steadily decreased. Behavioral studies began more and more to acquire a "physiological colour." By the end of the 1930's, no laboratory remained in Russia in which naturalistic studies of animal behavior were conducted. Special courses on comparative psychology were also stopped by the 1930's.

The causes of the curtailment of naturalistic studies in the USSR in the 1930's, at the time when such studies were increasing in the West, were complex. Certain principle causes and conditions can be distinguished.

A main cause was the system of the organization of Soviet science. In the USSR science had no financial sources other than the state. Before "The Great Turning Point" (1928) and the institution of strong central planning of scientific research, it was possible to receive financial support from the different Narkomats (Peoples' Commissariats, that is ministries), which were free to choose who would be given how much support

and for what. This explains the appearance of a great number of zoopsy-chological institutions organized under the Narkompros (Peoples' Commissariat of Education) in the 1920's. However, the negative effects of an exclusively state financed science began to appear.

By the end of the 1920's, the system of exclusively state financed research and the intensified centralization led to emphasis of the practical application of scientific research as the main criterion for the evaluation and approval of the financing of concrete research. Favorable comments on the "practical usefulness" of particular research in a laboratory or an institute began to be widely used in scientific critiques. The propaganda for applied behavioral studies became especially pervasive after "the Great Turning Point," when the slogan, "Science for the service of the building of socialism," became very popular (Zalkind, 1930; Kolbanovsky, 1932). These developments may explain the section, "Practical significance of biological psychology," in Khotin's paper in this issue.

Another important factor in the curtailment of naturalistic behavioral studies was the ideological pressure put upon science after the revolution. The process of ideologizing Soviet science was complex and long. It differed for the individual sciences according to the content of the ideology introduced into them, the methods used to influence each scientific community, the distribution of roles among the separate groups of scientists, and so on. After 1922, the polemics among the supporters of the different approaches to behavioral research sharpened. A new group of scientists, psychologists with the behaviorist orientation of B. Borovsky and his coworkers, acquired a clear ideological "colour." More and more of the discussion was occupied by statements of conformity to the methods, results and conclusions of "Marxist psychology." The appearance of "Marxist physiology," "Marxist biology," and other "Marxist" sciences, makes it possible to distinguish essential changes in the language and style of the polemics.

A significant factor in the criticism of Wagner's ideas in the 1920-30's was the "ideological vulnerability" of his conceptual and categorical scheme of description and explanation of behavior. At first, this related to the term "biopsychology" and to the treatment of "psychology as a part of biology" (Wagner, 1923a,b). This treatment was "open" to an accusation of the biologicization of mind, i.e., the reduction of psychological and social processes to biological ones. Biologicization was "a mortal sin" in the eyes of the ideologists of those years (Frankfurt, 1926). Thus, it is no accident that Wagner rarely used the term "comparative psychology." However, using "psychology," or psychological terms to describe and explain animal behavior evoked accusations of subjectivism, anthropomorphism, idealism, and other "isms" against Wagner. He used psychological terms to separate his own research from the studies of the physiologists (Wagner, 1921). We can only speculate what might have

happened if Wagner had used the term "ethology," proposed by G. Zeleny (1913b, p. 1193) to describe his research.

Another cause of the "neglect" of Wagner's views was his consistent, strong protest against any attempts to ideologically substantiate an advantage of one or another approach to scientific problems. Wagner wrote:

The tendency to call everyone a vitalist if they refuse to follow blindly the doctrines of materialistic schools à la Molleshot and Buchner and he who speaks of psychology as if it is something more than the data of chemistry, anatomy and physiology is so zealously propandized, that the word "vitalist" sounds to "a real scientist", the way the word "heretic" sounded to a real religious person in the Middle Ages. (Wagner, 1925-1929, 1927 volume, p. 18)

It may be that it was Wagner's activity against the monopolization and ideologizing of behavioral studies that prevented the publication of his own works in this field after 1930: the tenth and eleventh volumes of "Essays on comparative psychology" as well as his last monograph, "Comparative psychology, its field of study and tasks." These are still unpublished. Probably the same cause prevented the publication of Khotin's paper (in this issue) in spite of citations from Lenin and Engels, which should have confirmed the ideological usefulness of his ideas and approach to animal behavior.

The ideological circumstances and the tendency to monopolize behavioral studies supported by the system of central planning and financing of science resulted in the concentration of behavioral studies primarily in physiological institutions, and to some extent in zoological institutions. However, the intellectual tradition of Wagner's approach to behavioral studies was not completely interrupted. During the 1930's several groups of scholars continued investigations of innate behavior in field and laboratory. Investigations were continued by Wagner's pupils, B. Khotin and G. Roginsky, who worked in the Brain Institute. Although it seems paradoxical, the main ideological critic of Wagner, V. Borovsky and his collaborators carried out many theoretical and practical experiments devoted to the study of instinctive behavior (Borovsky, 1935, 1936). However, in 1936 as a result of the mass reorganization of psychological institutions stimulated by the resolution of the Central Committee of the Communist Party "On pedagogical perversions in the Narkompros system," Borovsky's laboratory in the Institute of Psychology, Pedology and Psychotechnics was closed. Borovsky and some of his collaborators "migrated" to the Zoological Institute of Moscow University where their research was continued. A year later, Borovsky, threatened by arrest, was forced to move from Moscow and the laboratory fell apart. Nevertheless, several of Borovsky's pupils continued to study field behavior in different sanctuaries (Skrebitsky, 1939; Kaftanovsky, 1941).

Another group of scholars continued Wagner's tradition by finding refuge in the Institute of Evolutionary Physiology and Pathology of Higher Nervous Activity n. I. P. Pavlov. The Institute was organized on the basis of Pavlov's laboratories in Koltushi by Pavlov's closest pupil and successor, L. A. Orbeli. L. Krushinsky began to work in the Institute in the 1930's.

However, the work by these investigators was not extensive. The reports were often published in marginal journals and literally were lost in the tremendous stream of literature devoted to the physiological analysis of behavior. There was no special periodical concerning field behavioral studies in Russia.

SUMMARY

It may be concluded that the curtailment of naturalistic studies of animal behavior in Russia resulted from a complex of causes. The main cause was the system of organization and financing of science aimed at the support of utilitarian and ideologically "useful" research. Scientists who did naturalistic studies of behavior, unlike the physiologists, could not prove "the usefulness" of their work for "the building of Socialism." This led to the disruption of their institutional bases that had begun to be formed at the beginning of the 1920's. The absence of a base, i.e., institutes, journals, scientific societies, a system of education, diminished the interest in such research in the USSR. The politics of the isolation of Soviet scholars from the international scientific community, actively carried out by Stalin's government, prevented Russian scientists from becoming familiar with the works of their Western colleagues. And, accordingly, investigations by Russians remained unknown to Western scholars.

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ANOTHER LOST WORLD OF RUSSIAN PSYCHOLOGY

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Throughout twenty years of investigation on published and unpublished materials and personal contacts with major and minor figures of Russian psychology, I was always upset by discovering new events, new stories and new texts I had never gotten wind of. Recently, during my integral translation into Italian of *Thinking and Speech* by Vygotsky (1934), I began with the last Russian reprint of 1982, but I found that this reprint contained a text very often different from the 1956 reprint, and that the latter was different from the first edition of 1934. However, our Russian colleagues have been going on quoting the 1982 reprint, likely because they themselves do not know this detective story of Vygotsky's work or they have lost their memory of their scientific history. For instance, what really was paedology; what did this psycho-pedagogical movement really pursue in the twenties and thirties? We have reasonable answers in recent monographs by Western scholars (Joravsky, 1989; Van der Veer & Valsiner, 1992), but we are yet waiting for a more exhaustive interpretation from Russian scholars.

Reading all the interesting texts published here, another new world disclosed itself to me. Some missing links appear now in a new light, all concerning the affair of Russian comparative psychology in the first half of this century.

I wish to start from a personal recollection. In 1972, during my first stay at the Institute of Psychology of Moscow, I was walking near Gorky Park when I suddenly saw a plaque on the crumbling wooden front door of an old building. On the plaque was written "Darwin Museum." I had found by chance what I had been searching for a long time after I had read of this Museum in the classical *Handbook of Soviet Psychology* by Cole and Maltzman (1969). No Russian colleague had been able to tell

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me where this Museum was. And when in 1975 I visited this Museum again, with an Italian colleague, the late Raffaello Misiti, the official guide accompanying him was reluctant to believe in the existence of this Museum because she had never heard of that institution. She admitted her ignorance only when I accompanied her and my friend to the Museum.

In this place there was an unbelievable collection of pieces showing the evolution of animal species and the research in comparative psychology by Ladygina-Kots (1889–1963). The Museum had been founded by her husband, A. F. Kots, at the beginning of the twenties. The most important work by Ladygina-Kots was her comparative analysis of the cognitive and emotional development of a child (her son Rudy) and a chimpanzee, illustrated in the splendid, but very rare book *Infant Ape and Human Child* (1935; the English summary was reprinted in 1982). Ladygina-Kots' approach lay in studying the common lines and specific lines of psychological development in different animal species. Her orientation was not reductionistic, but searching for general properties in the behavior of different animal species, and stressing the differentiation which emerged at the behavioral level in animal evolution. Her genuine Darwinian approach did not fit the Pavlovian reduction of the behavior of different animal species to common general mechanisms, that is, conditioned reflexes. Her research activity was discouraged and was not developed further beyond her personal contribution.

One may find a similar orientation in comparative research on animal and human behavior in the work of Wagner and Khotin. These authors clearly pointed out the theoretical absurdity of reducing the variety of behavior in different animal species to common chains of conditioned reflexes, as was claimed by Pavlov and his pupils (for Pavlovian research comparing different species see Vatsuro, 1948; Voytonis, 1949; Razran, 1961). Khotin, attacking in his *Biological Psychology as a Science* (1934–35) both the reductionism “from below” and “from above,” regarded them as metaphysical interpretations of the complexity of behavior (“Denying the existence of specific differences between animal and human psychological activity, they both arrived at metaphysics”). It is the same remark made by Vygotsky (1925), referring to Wagner's work, and by Luria more than fifty years later (1977). The following statement by Khotin might be directly accepted by the Vygotskian or historico-cultural school. “The cause of the failure of physiological monism ‘from below’ was [. . .] the fact that the representatives of this trend [very likely Pavlov and Bekhterev, LM] reduced all behavior of animals and humans to biochemical and physiological processes and went no further. They overlooked thereby the historical path that animals followed from protozoa to human beings, during which they elaborated different types of psychological activity corresponding to different stages of evolution.”

The other very important theme that was discussed by Russian comparative psychologists was the need of a unifying principle to explain the behavior of animals and human beings. Of course, taking into account the previous criticism of physiological reductionism, the principle was not found in the conditioned reflex, or in another kind of physiological mechanism, but it was identified in the theoretical way to organize empirical data on animal and human behavior, that is, on the concept of evolution. The conditioned reflex was considered only a brick in the evolution of behavior. It was not the behavior itself. In other words, the physiological mechanisms or the behavioral patterns should be read through a more comprehensive principle and should not be reduced one to the other or vice versa. The unifying principle should serve to link the disconnected trends of research in psychology, each one following its own theoretical principles.

The crisis of psychology, illustrated by many scholars in the twenties, e.g., Buhler (1927), was explained by the branching out of theoretically different psychological schools (behaviorism, reflexology, Gestalt theory, psychoanalysis, etc.). In his book *The Historical Significance of the Crisis in Psychology* (1926, first published in 1982), Vygotsky again referred to Wagner on this crucial aspect of contemporary psychology. Although Vygotsky tried to point out other unifying principles to overcome the then current crisis in psychology, it is worth noting that the Russian comparative psychologist, Wagner, and the Russian developmental psychologist, Vygotsky, were emphasizing the same problems and looking for similar solutions. They wished to make a stand for their view of the relevance of evolutionary and developmental dimensions of behavior, against all attempts to overwhelm the complexity and variety of behavior by means of general and superficial mechanisms or abstract notions.

What the Pavlovian school of the hard dialectical materialistic psychology offered was a static view of behavior built upon simple physiological mechanisms and psychological structures. Indeed, this represented the scientific side of the rigid and crystallized approach pursued at a political and social level. This scientific approach fitted well in a static view of society.

It is not surprising that the members of both a comparative psychology school and a historico-cultural school, let us say, the members of an evolutionary-historical approach to human behavior, were persecuted. What is today a lost world of theoretical and empirical research was also a great opportunity to develop a dynamic view of human behavior as a necessary basis for the psychological growth of human beings in a democratic society. As we read in Vygotsky's or in Khotin's texts, the awareness of the progressive social relevance of their positions was always clear as it was clear to their opponents that these ideas were dangerous for the monolithic Russian society born after the Revolution.

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DEVELOPMENT OF ETHOLOGY IN THE U.S.S.R. (From a Report to the XXI International Ethological Conference)

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We have been asked: why do animal behavior researchers in the USSR call themselves ethologists? In fact, in addition to classic ethology, our work relies on the methods and concepts of Pavlov's physiology, comparative psychology and zoosociology. Such an approach is eclectic. The famous biologist-philosopher, A. A. Liubischev, wrote that eclecticism is a legitimate stage in the development of a complex, progressive theory. Eclecticism is that situation in which different concepts cannot yet be combined to form an unambiguous theory, but there is still a possibility that in due time contradictions would be eliminated. In this situation, all evidence contradictory to a theory would be freely discussed to stimulate a search towards a true synthesis.

The term "ethology" gained currency in the USSR from about 1965 onward when it came to be used by some zoologists of the older generation acquainted with ethological research in Western Europe. That the term "ethology" was widely adopted is explained by the influence of the theories advanced by Lorenz, Tinbergen, Eibl-Eibesfeldt, Chauvin, Leyhausen, Tembrock, Dewsbury, Manning and Hinde, whose research and books acquired a great popularity in the USSR. From that time, the situation developed rapidly, as zoologists came to see in the advances of ethology new possibilities for interpreting their own data, formulating new problems and the advantages resulting from the application of ethological methods. B. P. Manteifel and V. E. Sokolov were active leaders in promoting ethological research in the USSR. In 1972, a newly formed

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scientific organization held its first conference, which assembled 250 scientists from 45 institutions. The All-Union Ethological Conference in 1984 brought together as many as 1000 scientists from over 60 institutions. Today zoological conferences in Russia include at least one session on ethology, and many ethological papers are read.

Despite the fact that the development of ethology in the USSR was sudden and rapid, it had a firm basis in two traditions. The first tradition was the work of I. P. Pavlov and his pupils. It was Pavlov who identified the capability of animals to adapt to the most important feature of the surrounding world: time, i.e., the sequence of events. The founder of the Georgian school of behavior and physiology, I. S. Beritashvili, studied the ability of animals to learn another important regularity of the world: space, i.e., the location of objects. The principal scheme of his experiments was the development of conditioned reflexes in dogs when the feeding trough was situated in an adjacent room or behind a partition.

Another of I. P. Pavlov's collaborators was P. K. Anokhin, who as early as 1935 demonstrated the ability of animals to evaluate the results of their reactions and to correct their behavior accordingly. Aware of the complexity of behavior, Anokhin developed the theory of functional systems. The studies by Anokhin are being continued by his followers at both physiological and behavioral levels.

Physiological science in the USSR could perhaps have exerted more influence on the development of behavioral research in the USSR but for the following dramatic event. In 1950, the scientific session of the USSR Academy of Sciences and of the USSR Academy of Medicine took place. Obscurantists and careerists claimed that the trends of research carried out by Anokhin and Beritashvili contradicted Pavlov's theory. The viewpoints of the scientists who criticized Pavlov and assigned a minor role to conditioned reflexes in animal behavior were considered most unacceptable. Nevertheless, in some physiological institutes after a period of time, the studies of behavior were continued. The theory of conditioned reflexes remains the most important foundation for the study of animal behavior. D. A. Biroukov formulated the notion of "natural conditioned reflexes," which are formed after two or three combinations with conditioned stimuli and of the confirming conditioned reflex, which persists for a very long time. Examples are the defensive reactions in hares to the rustle of paper and in ducks to a slap on open water.

The second tradition was the naturalism that is characteristic of Russian zoology, with its deep knowledge of, and keen interest in, the study of animal habits, based on the work of V. A. Wagner, a specialist in spider behavior; A. N. Promptov who studied the behavior of birds; and N. N. Ladygina-Kots, who pursued research with primates during the first half of this century. It was this second tradition in zoology that evolved into Soviet ethology in the 1960's and the 1970's. A. D. Slonim and his associates studied innate and natural reactions in newborn ungulates and

TABLE 1
Behavioral Investigations in the USSR Reported at All-Union
Ethological Conferences

	<i>Percentages of Papers on Various Topics</i>		
	<i>Year</i>		
	<i>1972</i>	<i>1977</i>	<i>1984</i>
General behavior	23.6	28.0	4.3
Physiology and genetics of behavior	6.0	10.5	13.0
Ontogenesis	4.7	8.5	9.4
Communication and orientation	18.3	11.5	11.0
Species-specific behavior	21.8	23.0	22.7
Zoosociology	10.7	1.0	14.3
Interspecific behavior	3.4	2.5	4.3
Behavior and anthropogenic influence	4.7	5.0	8.8
Applied ethology	6.8	10.0	12.2
Total number of papers	147	203	492

predators, as well as behavioral ontogeny, including the transition of a newborn from dependence upon the maternal organism to independence in the external environment. Slonim and his school also studied thermoregulatory behavior.

Experiments involving a detour to obtain food were carried out by L. V. Krushinsky, who developed a theory of elementary reasoning activity. In experiments with many vertebrate species, Krushinsky and his associates studied the ability of animals to define the direction of the movement of bait seen through an opening in a screen. In another approach, the ability of animals to differentiate flat objects from volumetrical ones was investigated. Different species showed differences in the speed of learning the response required to solve the problem as well as in the ability to solve problems upon their first presentation. The latter, according to Krushinsky, is the most important indicator of the development of elementary reasoning activity.

Several physiologists are known for their studies of the zoosociology of apes. These are V. A. Kryajev, N. A. Tikh, and L. A. Firsov, who released chimpanzees on an island in Central Russia and observed the process of adaptation of the apes to the unusual ecological conditions. Similar studies are performed by V. G. Chaylian in the Institute of Experimental Pathology and Therapy in Sukhumi. He formed three free-ranging populations of apes living in natural conditions throughout the year on the Caucasian coast of the Black Sea.

Soviet ethology is being studied today in scientific institutes, universities, preserves and zoos. Table 1 presents only some past and present

research and we regret that we cannot report all of the research being done. The largest group of scientists works in the Severtsov Institute of Animal Evolutionary Morphology and Ecology of the USSR Academy of Sciences (about 70 persons); about 30 persons carry out investigations at the Moscow State University, and in the Institute of Cytology and Genetics, the Siberian Branch of the USSR Academy of Sciences there are about 20 persons doing ethological research.

Numerous studies concerned with the ontogeny of behavior were carried out at the Institute of Higher Nervous Activity in Moscow, such as on the ontogeny of bird behavior by S. N. Khayutin; the manipulatory activity of primates by K. E. Fabri, and in kittens by K. Shuleikina-Turpaeva.

Finally, the development of applied ethology in the USSR deserves mention. Approximately 200 scientists work with domestic livestock and there are many investigators engaged in research on game management, agricultural entomology, and fish behavior in the numerous institutes of fisheries in sea and inland water bodies.

In the field of behavior genetics, D. K. Belyaev, L. N. Trut and their colleagues, for more than a quarter of a century, studied changes in the behavior of foxes in the course of domestication. Since the ability to be domesticated and aggressiveness are the most general traits associated with the functioning of the hypothalamus-pituitary-adrenal-reproductive system, breeding for these traits brought about important changes not only in behavior but also in fertility, coat color pattern, shape of ears and tail, etc.

Another active laboratory is headed by D. S. Pavlov who is investigating the behavior of fishes in relation to water currents. They have achieved important results that are used in the design of waterways for fish to detour the dams of hydroelectric stations and to prevent the fish from getting into irrigation canals.

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